SCIENTIFIC AMERICAN

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THE NAVAL GUN FACTORY, WASHINGTON.

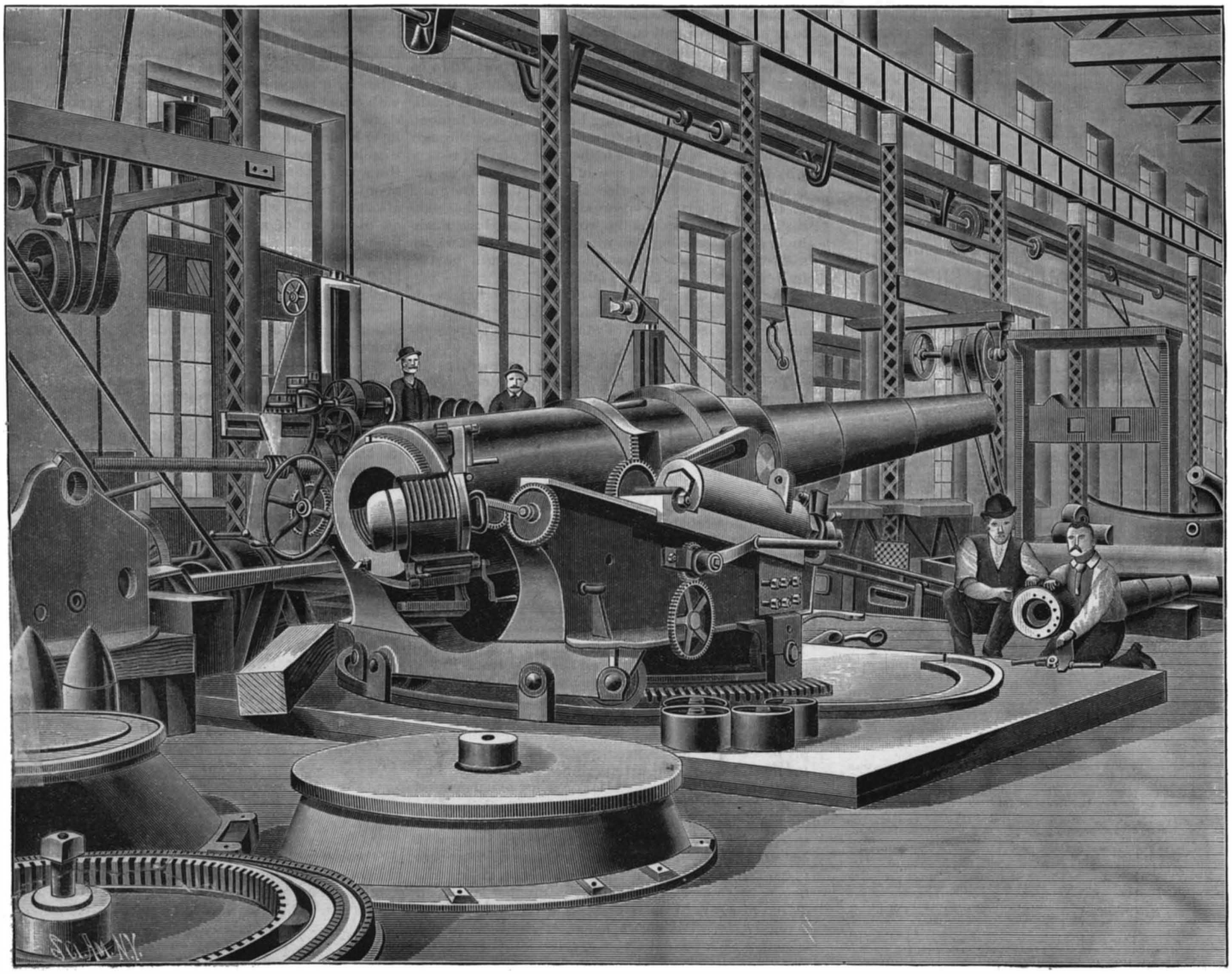
The largest of the modern high-powered guns, entirely of American manufacture, thus far completed, are the two 12 inch guns for the Monterey, the new monitor now nearly finished at San Francisco, and these pieces, as they were assembled at the Washington gun factory, were believed by our very competent ordnance officials to be equal, if not superior, to the best guns of the same caliber made anywhere else in the world. The acquirement of the plant and the establishment of a factory capable of turning out such guns have been among the most noteworthy of the achievements of the national government during the past five or six years. Within that period about two millions of dollars have been expended upon the Washington gun factory, and it is claimed by officials of the ordnance department to be at the present time the most completely equipped establishment of its kind in existence. The accompanying view represents the completion of the work of "assembling" a gun upon a foundation provided for this purpose in the factory, this branch of the manufacture including as well the adjustment of the carriage and all its parts to operative position in connection with the gun, the horizontal and vertical movement of the latter, as required on shipboard, being practically tested, and the breech mechanism carefully adjusted, that the gun and its carriage may go forth, as far as possible, a faultless piece of work.

The original gun foundry board, in recommending the establishment of two separate gun factories, one for the army, at West Troy, N. Y., and the other for the navy, at Washington, considered that with only one factory there would be an almost unavoidable conflict of authority between the two departments, and that their needs in many respects, particularly as to the gun carriages, were so dissimilar that it would be the best economy to have two separate establishments, aside from the fact that the total productive capacity would thus be greater. For both of these factories, however, the government buys the forged and tempered material from private firms, who furnish the several parts or forgings of which the guns are made. At the government gun factories is performed the work of putting together or "building up" the guns, the cutting of the rifling in the central tubes, the manufacture and adjustment of the breech-closing mechanism, and the carriages for the guns for the navy are built at the Washington factory. One of our views shows a portion of one of the gun carriage departments, where an armor plate has been returned after the recent tests at the Indian Head proving grounds, the plate retaining its almost perfect shape, notwithstanding the severe blows it received from the projectiles.

It is the conclusion thus far, after the costly experiences had in making large guns in England, France and Germany, during twenty years past, that what is called the "built-up" system affords guns of far higher power and greater endurance than can be produced in any other way. In the guns for our navy highly elastic open hearth steel of the finest quality is used, a central tube, forged from a single piece of steel, and bored out to the required caliber, forming the body of the gun. Over the breech end of the tube, and extending along it for about two-fifths of its length, is shrunk a steel jacket, the shrinking of the jacket slightly compressing the tube. Upon the jacket is then shrunk, in a similar manner, a layer of broad steel hoops, designed to exert a considerably greater pressure upon the jacket than is that of the latter upon the central tube, after which the part of the tube in front of the jacket is inclosed by a series of gradually tapering hoops extending nearly to the muzzle. With this construction, when the gun is fired, the expansion of the central tube by the enormous pressure within it brings a due proportion of the strain upon the jacket and hoops. To surely attain this result, the various parts of the gun tube, jacket and hoops, must be all made and fitted with mathematical accuracy, their surfaces being true to the thousandth part of an inch, each part being also tested separately to determine its tensile strength and elastic limit. The strain each part will be called upon to bear in actual service is calculated, and it must be proved able to stand that strain before being placed in the gun.

After the assembling of the parts forming the body of the gun, the piece is taken to an immense lathe, where the rifling is done, the most skillful mechanics in the country being employed at the Washington gun factory. The rifling adopted for all guns of the United States service is the "polygroove system," with a twist increasing from zero at the powder chamber to one

(*Continued on page 294.*)



THE NAVAL GUN FACTORY, WASHINGTON—ASSEMBLING LARGE GUNS.

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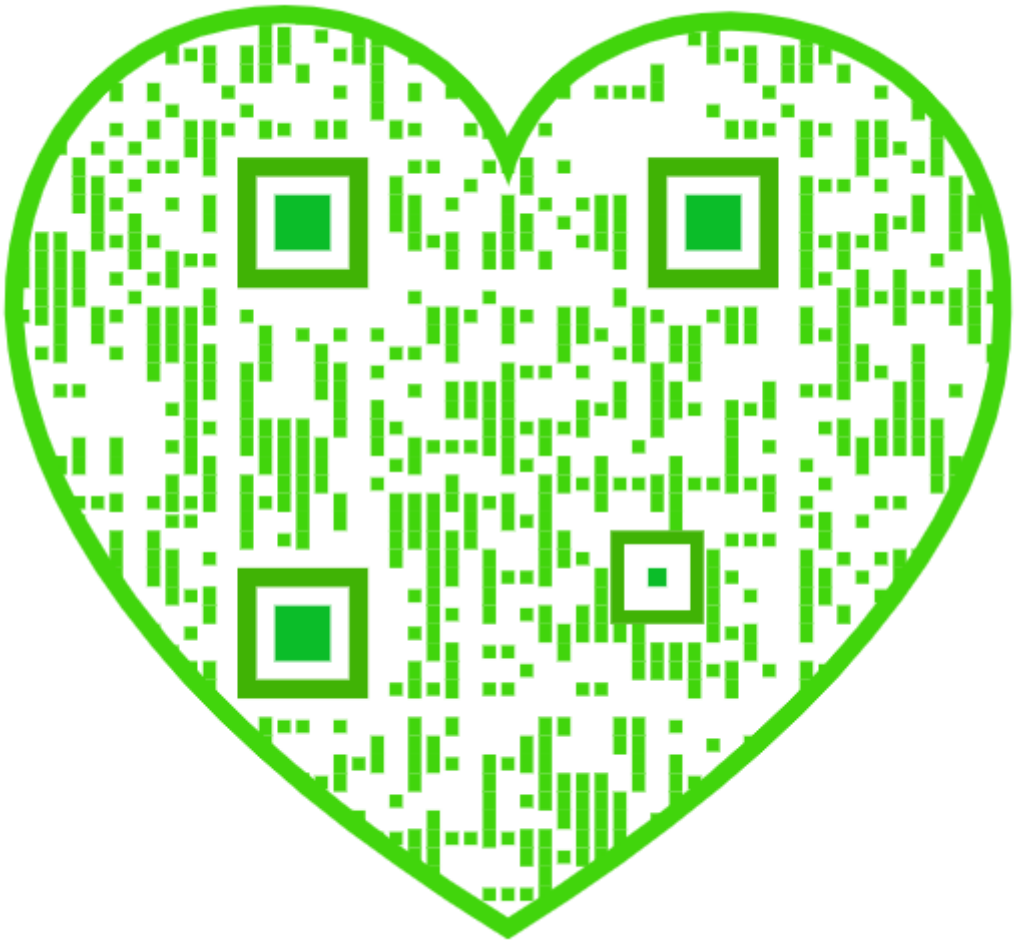

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STEADYING VESSELS AT SEA.

At the recent meeting of the Institute of Naval Architects, in London, Mr. J. I. Thornycroft read a paper on the steadying of vessels at sea. He gave an account of some experiments recently made on the yacht Cecile. The vessel was provided with a shifting weight which was arranged under the floor of the cabin and connected with a pendulum and a hydraulic apparatus, in such a manner that when the vessel rolled, the weight was shifted so as to counteract the rise of the vessel. In this way he was able to decrease the rolling from about eighteen degrees each way; when the apparatus was not in use, to about nine degrees, when the device was put in operation.

The use of shifting weights for the trimming of vessels is in common use in this country, and has been for many years. It is chiefly employed on our river and sound steamers. In some cases the weight is shifted by mechanism, but a more common method is to make use of boxes containing iron weights, such as chain cables. The boxes are mounted on wheels, and when the boat begins to roll, the seamen, on signal from the pilot, move the weight as required to bring the boat back to even keel.

Quite a number of patents have been granted in this country for self-acting ballast-shifting devices, with pendulums to trim or prevent vessels from rolling. Among the earliest of these patents was that of Purse and Staley, number 1,460, granted in 1839—more than half a century ago. In this invention a weighted pendulum was used, which, by swinging when the vessel rolled, set gearing into motion that instantly moved a heavy weight athwart the vessel so as to counteract the rolling. This apparatus was arranged below decks and motive power from the main engine or from a special engine operated the mechanism.

Mr. Thornycroft is of the opinion that a contrivance on the principle described might be advantageously applied to sea-going vessels. The success of his recent experiment and the long use of analogous apparatus in this country support his views. The application of anti-rolling devices to Atlantic passenger steamers certainly would render the sea passage much more comfortable than it often is at the present time.

CALIFORNIA WINES.

An excellent quality of table wine, red or white, can be had of the wholesale dealers in California for from 50 to 60 cents per gallon. Each gallon fills from five to six bottles, making the cost to the vender but about ten cents a bottle, although he sells it at from 50 to 60 cents a bottle to the consumer. Very little native wine goes to the saloons, because the demand is small, the patrons usually preferring beer or stronger liquors. The hotels and restaurants are the channels through which the wines chiefly go to the tables, and the reason why there is not greater use of native wines is on account of the exorbitant prices charged, under the guise of foreign labels. A correspondent says he has seen casks of as fine claret as the world can produce made in Los Angeles; but the wine merchant sorrowfully said, "Every bottle of that splendid wine will be sold in New York under French labels."

The result of such frauds is not merely to impose on the purchaser, but also to diminish the inducement to make really choice native wines, because there is no market for them as such.

Large cargoes of California wines go abroad, to be reshipped to this country as foreign goods. The French manipulate them, put in a fancy bouquet, and sell them back to us at an enormous profit. Patriotism should lead us to patronize our own productions, which with a fair degree of caution we may know to be pure and wholesome.

The question is asked, however, if California wines are not adulterated. It is asked in reply, what they can be adulterated with that is cheaper than $10 a ton—the price of the native grapes to the manufacturer. There is no question about imitations and frauds; but this is not done in California, for the simple reason that honesty is cheaper there.

Electrical Ribbon Machines.

The City Council of St. Etienne have resolved to apply electric motive power to all the hand looms in the city, and contracts have been made with an electric company for the necessary plant and currents. The electric dynamos are to be driven by water from the city reservoirs. There is practically an unlimited supply of water in the reservoirs, with a fall of upward of 100 feet. To grasp the importance and far-reaching results of this innovation, it is necessary to understand that the bulk of the enormous output of ribbons ($22,000,000 a year) is the product of house industry. The weavers for the most part own their own looms, and operate them by hand in their own houses. There are 18,000 looms which are thus distributed among the homes of the weavers, while the number of looms driven by steam in the few ribbon factories of the town is only 5,000. The 18,000 looms of the independent weavers are valued in the aggregate at $4,500,000. What the city of St. Etienne proposes to do is to convert each one of the 18,000 hand looms into a power loom driven by electricity, the innovation being coupled with the adoption of electric light. The result of this change from slow, laborious, uncertain hand power to the swift, regular, unfailing power furnished by electric motors will be an increase in the productive capacities of the looms and a considerable reduction in the general expenses of fabrication. In other words, art will be wedded to modern machinery. The weavers of St. Etienne have always been the most artistic ribbon makers in the world, but they have enjoyed few mechanical advantages. Now the old order of things is to be changed, and the products of the St. Etienne ribbon looms, which have been a trifle more costly than similar products in some other countries, notably in Switzerland, will be turned out at the lowest possible prices. The weavers employed in the ribbon trade number 70,000.

Origin of the Term "Grippe."

La Medecine Moderne gives an extract from a meteorological journal kept at Versailles in the eighteenth century, and in which the meteorological variations are carefully noted day by day, with a few reflections upon remarkable atmospheric occurrences—storms, hail, thaw, etc.

Commenting upon the months of February and March, 1743, the journal says. "There was a prevalence of colds and inflammations of the chest at Versailles and Paris. The king named this malady 'la grippe.' It was observed that bleeding was wholly contra-indicated. Such persons as had not been bled, and who drank much, were the most quickly cured."

It results, then, from this document, that it was King Louis XV. who gave the name of grippe to the influenza that then prevailed under a meteorological state, as the journal shows, analogous to that of recent years and of the present year.

Wooden Pavements in Paris.

In an article on wood pavement in Paris, contributed to the *Revue Pratique des Travaux Publics* by Mr. Brown Vibert, the author remarks that, to insure durability, this class of pavement must be laid with considerable care. The concrete foundation should be 6 in. thick, and made with 300 lb. to 440 lb. of Portland cement to a mixture of 9 cubic feet of sand and 27 cubic feet of gravel. As soon as it has set, the concrete should be covered with a $\frac{7}{16}$ in. layer of mortar consisting of 660 lb. of Portland cement to every 35 cubic feet of sand, and left to harden two or three days. The blocks should then be set in rows separated from each other by a space $\frac{3}{8}$ in. wide. These cracks are filled with cement mortar, and a layer of broken porphyritic stone 1½ in. thick spread over the pavement. This layer is soon driven into the wood by the action of the wheels. Provision must be made for the expansion of the wood, and for this reason in wide roadways a space about 2 in. wide is left open along the sidewalk and afterward filled with sand. In a roadway 131 ft. wide an expansion of no less than 16 in. was observed to take place in fifteen days, the blocks being very dry. In Paris these blocks are 6 in. high, 3 in. thick, and 8½ in. long. The cost as laid is about 9s. 6d. per square yard for Landes pine and 14s. 3d. per square yard for northern spruce blocks. The duration is said to be about seven or eight years under heavy traffic and about fifteen under moderate.

The Best Stone for Roads.

In a paper read before the Boston Society of Civil Engineers, Mr. W. E. McClintock remarks that the specific gravity of a rock is no indication whatever of its fitness for road metal. Thus slate weighs 175 lb. per cubic foot and pure mica about 183 lb., but no one would think of using either of these for road metal. The best material for this purpose was, he considered, trap rock, after which he would place felsite, and then came granite. As regards the latter, however, it differs in quality, that containing hornblende being preferable to those with mica. The latter was soft and should not be used unless it was very difficult to get better material. In cases where the traffic is light and the stones previously mentioned difficult to procure, sandstone may be economically used for metal, in spite of its inferior wearing powers. Of two sandstones, he held that the coarser-grained was to be preferred. Gneiss he held to be of about the same value as a good sandstone.

Use of Carrier Pigeons at Sea.

According to the *Revue Maritime et Coloniale*, some important experiments have been recently made at Portsmouth relative to the use of carrier pigeons at sea. A depot of these birds having been established at the Eastney barracks, some of the pigeons belonging thereto were taken to sea by a torpedo boat, from which they were set free in series at a distance nearly equal to that of the coast of France. These birds almost invariably returned home promptly. On one occasion there was a thick fog on the other side of the channel; the pigeons set free circled for a few minutes around the boat, and then, getting their bearing, returned to Eastney without delay.

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The Manchester Merchants on the Chicago Exhibition.

A meeting of manufacturers, merchants, and others interested in this exhibition was held at the Town Hall, Manchester, Eng., on the 8th ult., with a view of affording manufacturers information upon the conditions under which exhibits might be made and space obtained. The *Chemical Trade Journal* gives the following report of the proceedings:

The mayor (Mr. Alderman Leech), presiding, stated that the Society of Arts had been appointed commissioners for the exhibition on behalf of the government, and introduced Sir Douglas Galton, Sir Cunliffe Owen, and Sir Henry Trueman Wood, as the representatives of the commissioners, who had also brought with them Mr. M'Cormick, the commissioner from Chicago, to lay this matter before the manufacturers and merchants of the district.

Sir Douglas Galton said the government had ultimately voted £60,000 ($300,000) for the purpose of representing England at Chicago, this grant enabling them to offer exhibitors space free of cost. He pointed out that other countries were making extensive preparations to be fully represented, and it was desirable that the manufacturers of the Manchester district should be also to the fore.

Mr. M'Cormick then pointed out that the United States were the best customers England had, despite the M'Kinley tariff. Moreover, Chicago was in the center of a large district where there had been a great deal of opposition to the tariff. By sending to the exhibition, manufacturers at home would be able to show the merchants of the great West how much cheaper they could sell their goods without the tariff, as exhibitors would be allowed to mark on their goods the cost to the buyer at Chicago, with the tariff and without the tariff, thus demonstrating what benefits the abolition of the tariff would carry with it.

Sir Philip Cunliffe Owen said that the Chicago World's Fair would be different to the ordinary run of exhibitions, as it would be essentially a business exhibition, and was intended for business purposes and not pleasure, as was the case with the Paris Exhibition. As to the objection that by sending our goods we only enabled the Americans to copy from us, he said, we and the Americans were brothers, and why should we not steal from each other. (Laughter.) He thought that in the face of the efforts that France and Germany are making, the manufacturers of Manchester would never cease to regret it if they did not go handsomely into this exhibition.

Sir H. Trueman Wood said that already much of the available space had been taken, and as yet barely any of the industries of Manchester were represented; he hoped those who wanted space would apply before it was too late.

Mr. Alderman Bailey then spoke strongly, deprecating the idea of exhibiting machinery at Chicago. If anybody in the United States desired to copy our machines, let them come over here and do it. (Applause.)

Mr. M'Cormick, in replying, pointed out that English manufacturers would best please the Americans by stopping away, especially in the case of the iron industry, in which they were developing an export trade. In answer to a question, he also stated that an article patented in England, and not in America, would during the exhibition be protected as if it were patented in both countries, and also that goods for the exhibition would be entered duty free.

The only point raised practically was whether it was advisable to send machinery to Chicago or not. Nothing was said about other industries, more particularly the chemical and allied industries, which are centered in the Manchester district. The information given, however, will no doubt be of interest to those who have any intentions of exhibiting, and, as was pointed out by Mr. G. Helm, though the opinion expressed by Mr. Bailey did exist to a large extent in Manchester, there was also a broader spirit, which, instead of evincing any jealously, rather courted competition, believing that mutual benefits would result. The mayor of Oldham (Mr. Alderman Emmott), in moving a vote of thanks to Mr. M'Cormick, said that as makers of machinery in England often complained of their goods not being known abroad, he thought they would appreciate the opportunities afforded them by the Chicago exhibition when looked at from an advertising point of view. After passing a vote of thanks to the Royal commissioners, the meeting terminated.

Ventilation of Underground Railways.

Those who are accustomed to travel much on the underground railways of London are aware, says the London *Practical Engineer*, from painful experience, the ventilation is utterly inadequate, while the quantity of smoke and other deleterious products of combustion with which the air in these tunnels is laden is a serious trial to the health of those passengers who happen to be afflicted with delicate lungs. With a view to improving the ventilation of these underground railways, an invention has been patented by Mr. Christopher Anderson, of Leeds, and an interesting trial of his system was made on a half mile length of the Metropolitan Railway, at Neasden, a few days ago. Mr. Anderson's invention consists of a long rectangular tube laid between the rails, the tube having valves opening downward at intervals on its upper side. This tube or flue is connected with an exhausting apparatus, while underneath the locomotive is a slider, which communicates with a down chimney connected to the smoke box. As the locomotive passes along, the slider presses open the valves in succession, and the products of combustion are drawn into the tube by an exhaust fan at the station, from whence they are delivered into an ordinary chimney stack, and so discharged into the air. The locomotive is so fitted that the gases and products of combustion can be delivered into the air through the ordinary funnel when the train is running in an open cutting, while during its passage through the tunnel the upper funnel is closed, and the down chimney from the smoke box connected to the exhausting trough or pipe between the rails in the manner described. At the trial to which we have referred the arrangement was found to work very efficiently, and complimentary opinions were expressed by a large number of influential engineers and railway managers who were present, respecting the value and practicability of the invention.

Kansas Salt.

BY H. C. HOVEY.

Anciently there were extensive lagoons and land-locked lakes in the region now occupied by the State of Kansas. These shallow waters held various mineral substances in solution, that would necessarily be precipitated in the course of evaporation. One of these substances was the sulphate of lime, which, being heavier than the rest, fell in the form of gypsum. First there were crystals of selenite scattered through the crevices of the underlying limestone. Then came thin crusts, and finally massive beds from five to twenty feet in thickness. Plaster factories have been successfully established at points where the gypsum can be worked to advantage. Occasionally, as in the bed near Geuda, the rock is hard as marble and is quarried as a fine building stone. Dental plaster and kinds of cement heretofore only had from Europe are now made in quantities. According to Professor Hay, this gypsum horizon was "the premonition of the great salt age," and is possibly related in order of time to the broad salt marshes described by Professor Mudge and other explorers.* Twelve such marshes have been found within the limits of the State, besides salt springs and saline streams. To these resorted formerly great herds of bison, as well as deer, antelope, elk, and other creatures, whose bones have been abundantly found along their margins. The density of the brine, tested by the salometer, varies from 13 to 45 degrees. Some of the marshes are small, while others are very large. One covers 1,000 acres, another 3,000 acres, and still another is described as seven miles long and one mile wide. In Meade County is a circular sink 150 feet in diameter, containing a black pool 50 feet deep, whose surface is twenty feet below the prairie level. This was formed by the sudden sinking of the ground in 1878. The efflorescence along the margin of many an ugly bog resembles newly fallen snow, and over the bog itself are scattered small oval domes of indurated mud crowned by sparkling saline crusts.

Further examination shows that these marshes and springs ooze from beds of gray shales, probably themselves formerly marshes. Below the saliferous shales, and resting on the permo-carboniferous rocks, are remarkable beds of pure rock salt, varying in thickness from a few inches to several hundred feet. Their contents seem to have been protected by strata locally known as "red beds," but which, being barren of fossils, the geologists have hesitated to classify. In Bulletin 57 of the United States Geological Survey, Prof. Hay gives his reasons for regarding them as triassic. Above the salt and below the red beds are non-saline shales. The region in southern-central Kansas overlying the beds of rock salt is about 130 miles in diameter, extending from Kanopolis to the Indian Territory. At Kingman, and perhaps elsewhere, shafts are sunk from which the solid rock salt is obtained that has found a ready market; but exact statistics are not at hand.

Aside from the mines, and from the solar works at Solomon, that have existed for a quarter of a century, there are about twenty salt plants in the Kansas field. As fourteen of these are owned by the three companies operating at Hutchinson, I decided to visit that place in order to inspect their methods and results. The city itself is highly attractive. It was laid out in 1871 by Mr. C. C. Hutchinson, whose name it bears. It has gained celebrity from its packing house, and is also a commercial center for a wide region. Like other Western cities it has suffered from overbooming, but is now recovering from the consequent reaction. It has an actual population of about 10,000, and is steadily growing.

The vein of salt was discovered here in 1887, and the first block was worked for two years by a New York firm that afterward sold out to the parties now operating on a far larger scale. Some 400 men, besides a few women and girls, are now employed in the various plants. The wells are driven in triple tubes. The outer, or jacket, tube goes down 80 feet through the soil and gravel to the red rock, its object being to exclude all surface water. The other tubes go down 775 feet, completely through the red rock and the salt bed, which is here 300 feet thick. Through the inner tube fresh water is forced, which is driven up again to the surface through the middle tubing, charged with a solution of salt. This is at first quite weak. The custom is to pump for only half an hour to begin with, and to increase the time as the subterranean reservoir is enlarged by solution. It takes a month for a well to get into thorough working order, *i. e.*, for the reservoir below to become sufficiently large to hold brine enough to fill a receiving tank. The aim is to obtain a saturated solution, having a strength of from 97 to 100 degrees by the salometer. When by too rapid pumping it gets down to 80 degrees, the brine is too weak for profitable working, and the well rests till it gathers strength again. The life of a well is usually three years; the cause of failure being the breaking of the pipes by the overlying shale. It is cheaper to drive a new well than to repair the old one. The brine, having stood in the receiving tanks 24 hours, is run into pans for boiling down. These pans are 26 feet wide, 115 feet long, and 14 inches deep; and are fired at the end of the pan into three large arches. Each pan consumes from 10 to 15 tons of coal daily, and yields from 100 to 125 barrels of salt. The pans are "raked for dripping" every two hours. The salt is then wheeled into the store room, where for thirty days it is allowed to drain through a perforated floor; after which it is ready for packing and transportation. According to Messrs. Mulkey and Vincent, to whom I am indebted for attentions, the output from all the Hutchinson plants is about 700,000 barrels annually. The entire output from the State is about 1,250,000, which supplies the present demand in the territory reached; but it could readily be increased to 2,000,000 annual output if necessary. It should be added that the Hutchinson Salt Company has one of the largest and most complete dairy and table salt refineries west of New York, supplying the creamery trade of Iowa, Missouri, Nebraska, and Kansas, entirely displacing imported brands in those States. We regret not being able to furnish other than approximate estimates, but they seem to be all that can be had at present. It is but fair to this new and growing industry to say that, in the opinion of the State geologist, the actual aggregate of products exceeds the figures now given. He recommends that a State salt inspector should be appointed, by whose authority more complete returns may be obtained.

* See 6th and 7th Reports State Board of Agriculture, on the "Geology of Kansas Salt."

Turrets of the Monitor Monterey.

The building of these turrets, recently completed at Bethlehem, Pa., marks the attainment in this country of a high state of excellence in the most difficult class of work required for the modern battle ship. The turrets are made of five armor plates each, every plate so curved that when the five plates are set together they form a perfect circle. One of the turrets is composed of plates 11½ inches thick and 4 feet 6 inches wide, or so high when set on edge. The other turret is heavier, and composed of 13 inch plates, 4 feet 4 inches high. All the plates were forged on the big hammer and bent to the required curve on the hydraulic bending press, next to the hammer.

The quality of each set of plates was tested by the process. Six plates were made for each turret, one of which was chosen to stand the test for the group. The plates were sawed and finished on the big saws and planers in the armor plate finishing shop. Where the ends of the plates touch they are joined by heavy steel keys. The keys are each four feet long and four inches square.

On the Monterey's decks the turrets will be pinned by the keys and fastened to a strong frame, to which they are clamped by enormous bolts, three inches in diameter. The 13 inch turret is fastened by 104 bolts, the other by 72 bolts. The 11½ inch turret set up in a perfect circle in the machine shop is large enough to contain an ordinary workman's cottage. It is 24 feet 5 inches in diameter, or about 80 feet in circumference. The larger is almost 29 feet in diameter, or over 90 feet around the outside.

Testing a Horse for Lameness.

When examining a horse with a view to purchasing, says a contemporary, always have him led down a steep or stony descent at the end of a halter and with no whip near him. Many horses when brought out of the stable are excited by the presence of strangers, and become still more so at the sight of a whip. A slight lameness may therefore be momentarily overlooked by the horse himself, just as a man, under strong excitement, will sometimes forget a sore foot. Leading the horse down a slope will show any defect in his forequarters, and running him back will develop any weakness that may exist in his hind legs.

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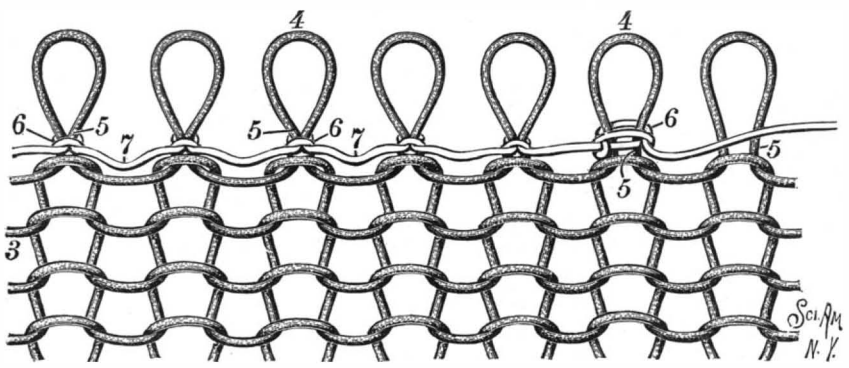
PRESTON'S IMPROVEMENT IN STOCKINGS.

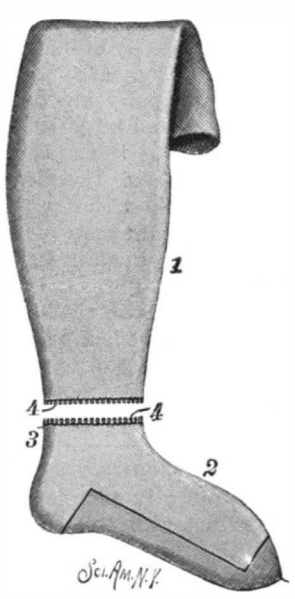
The illustrations show a new method of making stockings in two sections—a leg section and a foot section—to be connected and disconnected, for the purpose of renewing the foot section when worn. Former attempts have been made in this direction by finishing the joining edges with a selvedge, which necessitated patience and care in picking up the loops, in connecting the two sections, and in the union thus made the selvedged or finished edges presented a comparatively inelastic seam at a point where elasticity was most



PRESTON'S STOCKING—ENLARGED VIEW OF THE SECTION JOINING LOOPS.

essential in putting on and taking off the stocking. In the improved method, which has been patented by Mr. Leonidas M. Preston, of Bonham, Texas, the joining edge of the sections is formed with loops, normally protruding lengthwise and having their necks tied and fastened by a thread, as plainly shown in the enlarged view, the thread being tied round each loop transverse to its length.

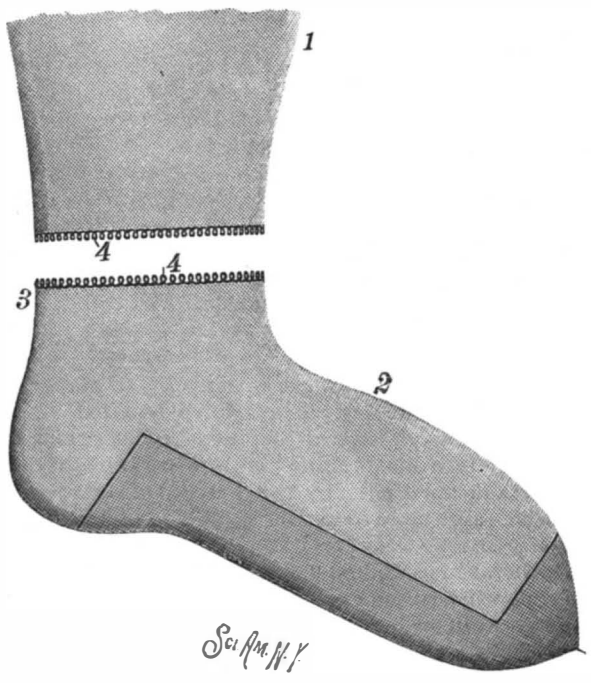
In the figures, 1 indicates the leg and 2 the foot section, 3 a part of the ankle portion of the stocking where the sections are designed to be connected, and 4 the projecting loops, which are held from being drawn back into the knitted body of the stocking by being fastened at the neck, 5, of every loop by slip knots, 6, in the transverse thread, 7, sufficient slack being left in the latter thread at points between the loops to provide an equal elasticity at the joining edges with that of other portions of the stocking.



PRESTON'S STOCKING.

The sections are designed to be connected by means of a needle and thread by the purchaser or user, the protrusion of the loops placing them in convenient position for this purpose, the union being made by the ordinary buttonhole stitch, and colored silk being used where it is desired to thus ornament the completed article. The union thus made is designed to afford a smooth, unbroken, and apparently undivided fabric.

A CANADIAN paper states that great difficulty is found in keeping brakemen at work on the trains which run through the St. Clair Tunnel, the discomfort from the accumulation of coal gas being so great that the men, although paid high wages, generally give up their places in a few days.



PRESTON'S SEPARABLE LEG AND FOOT STOCKING.

Concrete and Twisted Iron, as Used at the Stanford, Jr., University, Palo Alto, Cal.

The distinctive features of the Stanford, Jr., University relate not alone to the course and methods of training, but as well to the character of the buildings which have been erected. The style of architecture is modeled after the low, tile-roofed, adobe structures of the mission period. The buildings first erected were of hewn stone, massive, costly, and enduring. The later edifices are upon the same general plan, but are also unique and peculiar in mode of construction. They are monolithic, being moulded, walls, floors, and roofs, of artificial stone or concrete, with the addition of iron rods as an element of supporting strength for the floors.

The real problem of successful architecture clearly lies not so much in a choice of material as the proper use of materials common to all structures. Essentially the same elements enter into the construction of all important edifices. The great difference is in the way these are handled; whether the articles in question are used in their natural condition, or shaped and fitted by art, modified by preparation or manufacture, to meet the taste and means of the designer.

Buildings of stone are conceded to be the most enduring, and to best resist climatic changes, but they have been the most costly, where the granite or marble has to be transported from the quarry and dressed by hand for use in the walls. The same materials, broken in fragments, and again united by machinery with cement, and utilized in the form of monolithic (single stone) structures of concrete, prove cheaper, and, as use has demonstrated, more enduring, and resist heat better than natural stone.

Such structures are not new, but have heretofore been too massive and imposing. There was needed some device by which floors of stone need not be of excessive weight. In the construction of the new museum building and girls' dormitory at Palo Alto, this final problem seems to have been solved by a method first introduced upon the bay of San Francisco, which in effect utilizes the principle of the suspension bridge in every separate floor beam.

The floors, though formed of single slabs of artificial stone, are light and graceful in design, though capable of supporting great weight. This requisite strength has been secured by means of bars of twisted iron embedded within the mass, whereby the tensile strength of the iron—firmly held in place by the surrounding concrete—supports the floor.

The common iron floor beam can be depended upon to the safe limit only of its lateral or transverse strength. Were it possible to use the same weight of iron as a suspension rod, the safe limit would be the cohesive or tensile strength, which is about three times as great. In other words, a floor can be sustained by a suspension rod one-third the weight of the lateral beam. To break a beam by overloading, it is necessary to separate the particles forming the lower chord of the beam, by tension, or to disintegrate the upper member by compression. Incorporating the twisted bar in the lower portion of the beam, it acts as a suspension rod, and being firmly held at every point, the weight is distributed over the length of the bar. The iron thus embedded is also safe from corrosion and protected against fire, enduring with the concrete, which hardens as the years pass.

There is yet another feature of large interest here. It has been demonstrated that bars of iron, twisted while cold, and left a while before use, have their cohesive strength increased fifty per cent. The one-third weight is thus again reduced, showing that less than one-fourth the weight of iron affords equivalent strength.

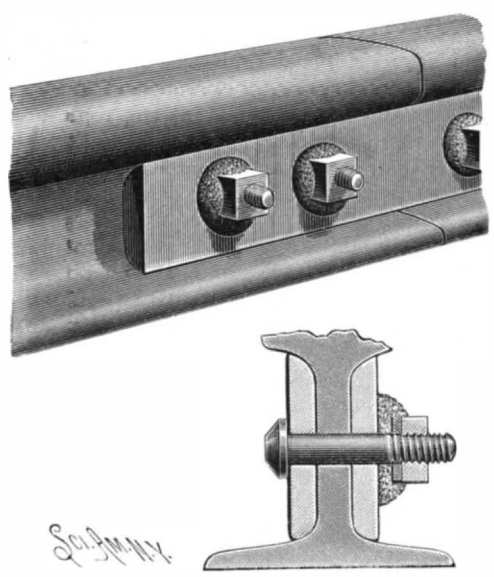
May not this departure at least indicate somewhat the character of the ideal building of the future?—*History of the Bay of San Francisco.*

Camphoid.

William Martindale says: It is known that iodoform is soluble (1 in 10) in Rubini's solution of camphor, composed of equal parts by weight of camphor and dilute alcohol. This requires fixing on the part to which it is applied. I therefore added 1 part of pyroxylin to 40 of the solution, and found it dissolved readily. Applied to the skin this preparation dries in a few minutes and forms an elastic opaque film, which does not wash off. The excess of camphor seems to volatilize, and as it disguises the odor of the iodoform its solution forms a useful vehicle for applying this drug. Pyroxylin dissolves readily in the simple solution of camphor, and this forms a cleanly basis for the application of many medicaments to the skin, such as carbolic acid, salicylic acid, resorcin, iodine, chrysarobin, and ichthyol. I suggest the name "camphoid" for the simple pyroxylin solution.

AN IMPROVED NUT LOCK.

The nut lock shown in the annexed cut is adapted for use on railroads, machinery, wooden structures, and for a wide variety of purposes. It has been patented by Mr. William P. Sweetland, M.D., of 397 Hayes Street, San Francisco, Cal. The lock is formed by means of an elastic non-metallic washer, to be placed upon the threaded end of each bolt. This washer may

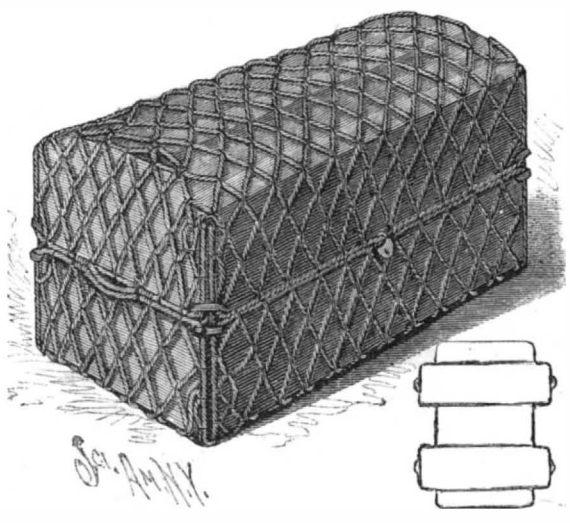


SWEETLAND'S NUT LOCK.

be of rubber or any fibrous material, or felt will answer the purpose, each washer being saturated with a hardening preservative compound, such as white or red lead and oil, or litharge and oil, or for which coal tar may be used, applied at the time of making the washers or just before their application. A metallic washer, preferably circular in shape, is placed upon each bolt to rest upon the non-metallic washer, as shown in the small view, and upon the securing nut being screwed down to place, the central portion of the elastic washer is compressed, so that its uncompressed edges partially embrace the sides and corners of the nuts. As the preservative compound hardens in drying, the nut is locked in place with such rigidness that a wrench is necessary to remove it. The washer, being elastic, also takes up any vibratory motion or jar, such as ordinarily causes the nuts to work loose.

AN IMPROVED TRUNK PROTECTOR.

An improved protective covering or envelope for trunks, portmanteaus, etc., consisting of an open network of cords, ropes, or similar material, is shown in the accompanying illustration, and forms the subject of a patent issued to Mrs. Carrie V. Thompson, of No. 38 Ashland Place, Brooklyn, N. Y. The small outline diagram shows the form in which the envelope is constructed, the ropes being bound together by twine, or sewed, riveted or otherwise fastened together at the intersection of the meshes. Handles, preferably of the same material as the network, are formed upon the ends of each of the projecting flaps by which the ends of the trunk are covered, and the whole is secured to the trunk by means of straps, ties, or clasps of any suitable description. The envelope preferably consists of a



THOMPSON'S TRUNK PROTECTOR.

strong, tightly made hempen cord or rope, although it may be made of leather, rawhide, or similar material, or of small metallic chains or wire ropes.

A RECENT issue of the *Bulletin de Musée Commerciale* gives the following statistics regarding the present production of aluminum:

	Lb. per diem.
The Neuhausen Works	1,000
The Pittsburg Reduction Company	600
The Metal Reduction Syndicate, limited	300
The Cowles Company	600-700 in alloys.

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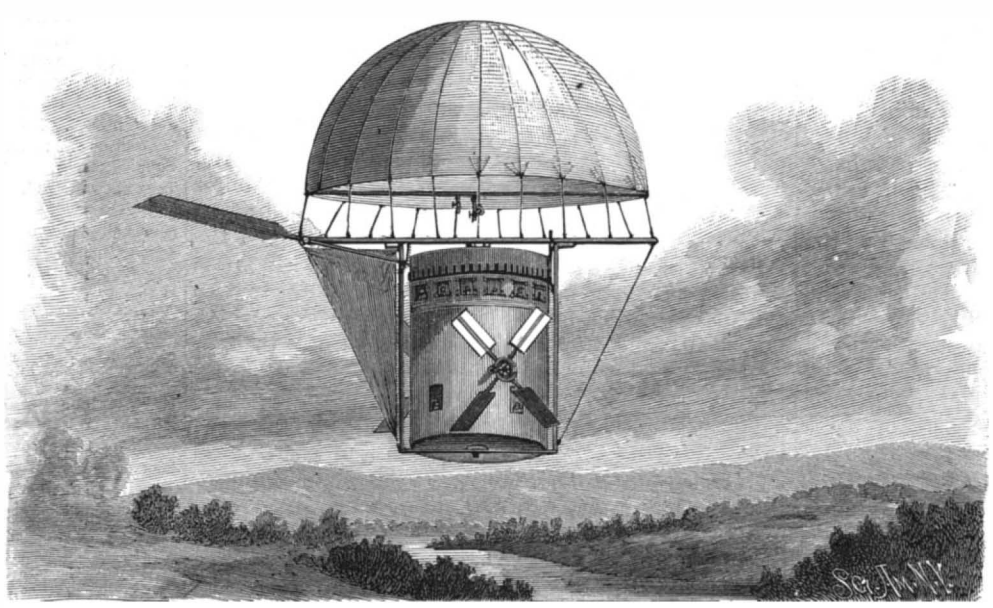
AN AERIAL SHIP.

The construction for navigating the air represented in the illustration is designed to be readily guided and controlled in its travel, irrespective of the direction of the wind. It has been patented by Mr. William N. Riddle, of Crowley, Texas. Its main body is substantially of an upright cylindrical form, and is divided horizontally into two compartments, the lower one for freight and the operative mechanism and the upper one for passengers. The body is centrally pivoted at its upper end to a main frame piece above, the lower end of the body also being centrally pivoted in the horizontal member of a yoke, in which the body is suspended from the frame piece, cords serving as braces. A circular rack, controlled by a spring catch upon the upper end of the body, holds the latter stationary in any required position in traveling around its vertical axis. Connected with the yoke and the stay cord at one side is a stationary rudder, and a laterally projecting second rudder is pivoted to one end of the main frame piece above, this rudder being capable of adjustment up or down, and being locked in position by a lever handle engaging a rack on the frame piece. Attached by cords to the latter is an upper gas receptacle divided into compartments, one above the other, united to form but a single buoyant chamber, but so connected with one another by central upright tubes that if one compartment collapses or bursts the others will hold up the ship. To propel the vessel, a horizontal shaft projects from each side, each carrying two upright partly circular tracks, one below and the other above, between which an upright propelling wheel is arranged to rotate upon the shaft. Each wheel is driven or rotated by gearing actuated by any suitable prime mover or motor within the body of the vessel, and the construction of the wheel is such that the paddles will have a feathering action, striking the air on their flat side during half of the revolution of the wheel and presenting their edge surface to the air during the other half of the wheel's rotation. The construction is such that the position of the wheels may be changed to give their paddles a flat or edge presentation to the air as desired, and to move the vessel upward or downward when necessary, it being designed that in lowering the ship it will not be necessary to permit the escape of the gas in the buoyant chamber.



RIDDLE'S AERIAL SHIP.

Gold Alloys.

Prof. Roberts-Austen has drawn attention to the fact that the properties of gold are changed in a most remarkable manner by alloying it with small percentages of other metals, and he lately exhibited a new series of alloys of this metal with aluminum. One of these alloys, containing 20 per cent of aluminum, forms an exception to the usual rule that the melting point of an alloy is lower than that of either of its constituents. This alloy has a fusing point above that of gold, the most infusible of its constituents. Curiously enough, the alloy with 10 per cent of aluminum follows the ordinary rule. These alloys have the most brilliant colors. The 20 per cent alloy is a brilliant ruby in tint, while those containing greater percentages of aluminum are purple in hue.

IT is stated that wasps' nests often take fire, supposed to be caused by the chemical action of the wax upon the paper material of the nest itself. This fact may account for many mysterious fires.

INGLETON'S IMPROVED STEAM PLOW.

The accompanying cut, which is from a photograph taken while the machine was in operation, represents the rear view of a steam plow designed and manufactured by Mr. E. Ingleton, of Brantford, Canada, an engineer who has had some 18 years' experience in steam cultivation and steam drainage in England, Germany, and Russia, and with every known system. The apparatus is doing some excellent work, and is not only a working but a commercial success. As much as three acres per hour have been plowed in a most excellent manner, and the average of a day's work may be set down at 20 acres, which is being done at a cost of 45 cents per acre.

As will be seen from the engraving, this plow is an entire departure from everything yet attempted in steam cultivating machinery, inasmuch as the plows operate across the track of and at right angles to the travel of the engine. By this means a serious objection has been overcome. In nearly all the attempts of steam plowing made on this continent, the system of direct haulage by traction engines has been adopted. It may be stated, however, that so long as the propelling wheels of a traction engine have to depend upon the loose and ever-changing surface of the soil for a sufficient "grip" to haul a gang of plows, so long will all attempts in that direction prove unsatisfactory. It is admitted that in dry summer weather, when the land is hard and traveling good, a traction engine will haul quite a large gang of plows; but it is different with anything in the nature of a steam plow.

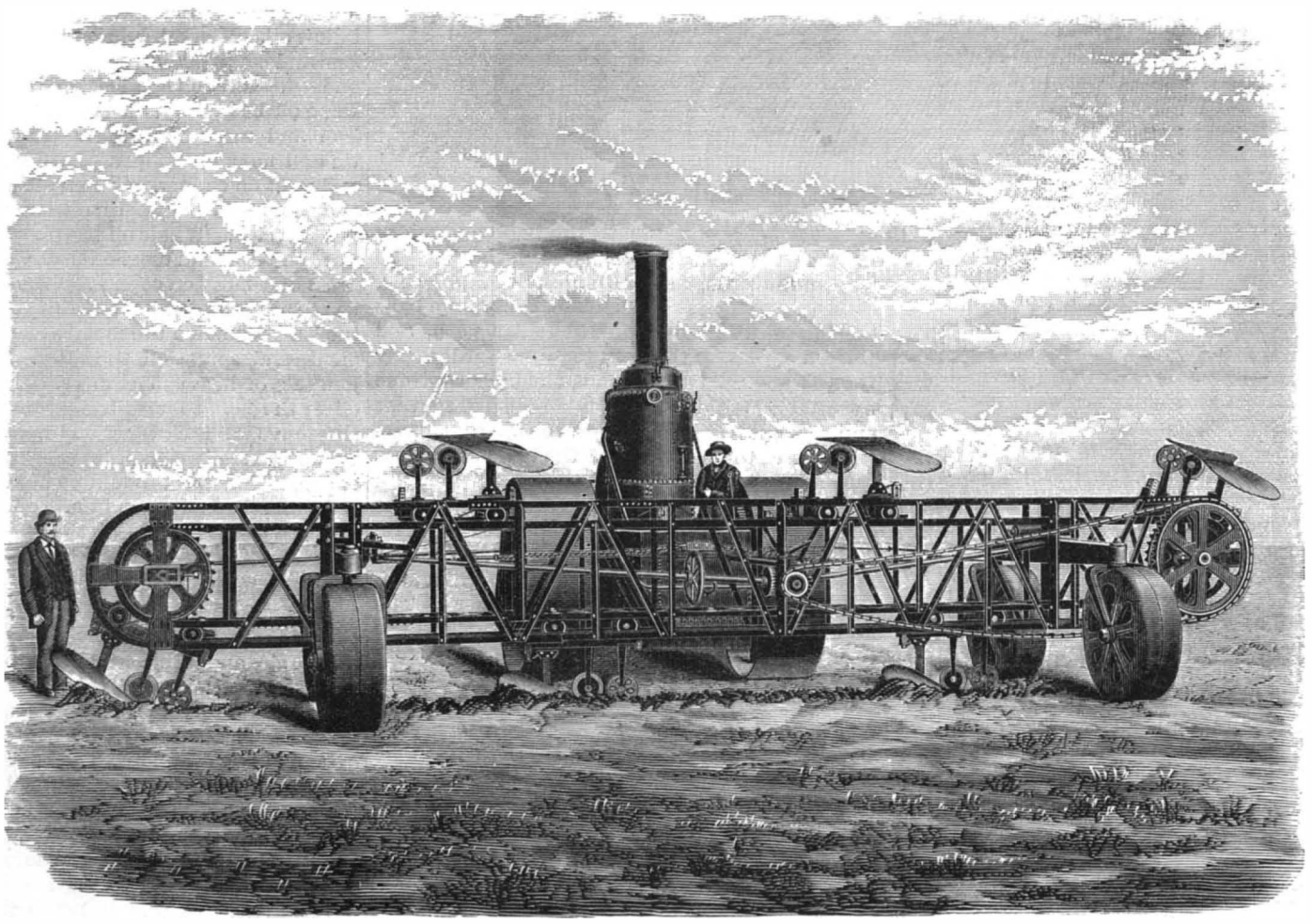
In the Ingleton system the resistance of the plows is against the side of the engine, and does not, therefore, hinder the forward move of the latter. This is the secret of its successful working; for, no matter what the condition of the land, so long as it is fit for plowing, a good traction engine, with suitable wheels, may be made to travel light. To haul a weight behind it, however, under certain conditions of soil is another question.

The main propelling wheels of the Ingleton engine are 7 feet diameter and 30 inches wide, which gives ample "grip" for propelling *itself* over any condition of land, while, owing to the width of the frame containing the plows (thirty-three feet), the engine moves forward at the rate of about half a mile per hour only, or *one-sixth* of the speed required by direct haulage, with a corresponding saving in power, fuel and water and wear and tear. Besides these advantages, it must not be forgotten that, owing to this saving of power in propelling the engine, a smaller engine will suffice to do the same amount of work than when hauling direct, for there will be found some conditions of land that it would take as much power to propel the engine over at the rate of three miles per hour as it would require to haul a gang of plows.

In the Ingleton system the plows travel through the soil eight times faster than the engine, *i. e.*, while the engine is traveling half a mile in one direction, the plows are moving at the rate of four miles per hour at right angles thereto, giving a maximum of work done to a minimum movement of engine.

The width of the plow frame may be doubled if necessary; in fact, it is recommended for large operations. This will further the advantages of this system. There is practically no fixed limit to the width of the plow frame, as each plow is mounted upon a small carriage, with four flanged wheels traveling on rails, and is independent to rise or fall, so as to follow all uneven surfaces of the land. By means of a lever placed within reach of the fireman, the main frame can be raised, and all plows taken clear of the land, with the power of the engine, and without stopping the machinery. The plows are fitted with an automatic apparatus for raising them clear of stones or roots, thus saving all damage from this source.

The main frame can be fitted with a seeder box, and Ingleton's patent harrow, so that the three operations of plowing, seeding and harrowing can be carried on at one time. The time is at hand when a good steam plow is required. It is surprising how little has been done in this direction, when we take into account the elaborate steam thrashing machine, which only deals with two or three tons weight per acre, while to plow an acre of land six inches deep one thousand tons have to be stirred, and that in a very short space of time.



INGLETON'S IMPROVED STEAM PLOW.

A Great Bridge for New York.

Modified plans have been prepared by T. C. Clarke for the North River bridge, proposed by the New York and New Jersey Bridge Company. The original plans provided for a center pier in the river, but this has been abandoned. The present design provides for a combined cantilever and suspension bridge. The river span will be 3,200 feet. The New Jersey end of the bridge will be at Miles Avenue, the New York City end at a point between the lines of Seventieth and Seventy-first Streets. A viaduct 100 feet wide, with four main tracks and three lines of sidings, will run through private property to a point between Eleventh and Twelfth Avenues, thence to a point above Thirty-eighth and Thirty-ninth Streets. A large union station will be built on the blocks between Thirty-seventh and Thirty-ninth Streets, Eighth Avenue and Broadway.

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Progress of Hippophagy.

Contrary to what is commonly supposed, a very respectable number of French men and women have for a long time been eating a large quantity of horse meat, because this food agrees with their stomach as well as their purse.

In our day, the consumers of solipeds have so increased that in many places, it appears, horse meat is sold at a much higher price than it was fifteen or twenty years ago, without, however, having reached such a figure as in Denmark for a few years past, and recently in Germany. In France, hippophagy, while remaining within reach of modest purses, has made surprising progress. In several localities ordinary butchery has been seriously affected by the competition of this new trade. For example, at Toulouse, the city of France in which the largest number of horses are consumed proportionally to the number of inhabitants, the butchery syndicate has formed itself into a sort of committee against the sale of horse meat.

At Paris, the first horse butchery was opened on the 9th of July, 1866. The number of solipeds slaughtered from that epoch up to the 31st of December of the same year was only 902. It rose to 2,758 in 1869, to 65,000 during the siege and the commune, to 5,732 in 1872, and to 10,619 in 1877. The horse butcheries numbered 48 on the 1st of January, 1874, and 132 on the 1st of January, 1889. At present, the price of horse meat is nearly half that of beef for corresponding cuts. Thus a fillet of beef is sold at 2½ francs per 500 grammes, and a fillet of horse meat at 1¼ francs. The inferior cuts, which are from 40 to 60 centimes for beef, are from 20 to 30 for those of horse meat. The solipeds seized after being slaughtered, as unfit for consumption, numbered 3,583 from 1868 to 1884, that is to say for 203,537 consumed in 17 years; 304 in 1886, for 18,435 consumed; and 245 in 1887, for 16,446 consumed.

At Lyons, Bordeaux, Orleans, and Troyes and other cities the output of the horse butcheries is enormous.

According to Prof. Thomassen, of the Veterinary School of Utrecht, hippophagy is in great favor at Rotterdam. Horse meat is used there as human food to an extent that is unknown in Denmark, Sweden, and Switzerland, as well as in several parts of Italy, such as Lombardy, Piedmont, Venetia, etc.

It is extensively used in Milan, while it is scorned in Turin. In the latter city, only 55 horses were slaughtered at the abattoir in 1888. The flesh of all of these animals was used exclusively for feeding the animals of a menagerie. Mr. Manuel Prieto regrets that hippophagy is not adopted in Spain, where it would benefit numerous poor laborers, to whom ordinary meat is an article of luxury on account of its high price.

The Annual Agricultural Statistics published by the Minister of Agriculture give the number of horses, asses, and mules slaughtered for human food at Paris and in the suburbs.—*La Nature.*

Improved Propulsion and Ship Design.

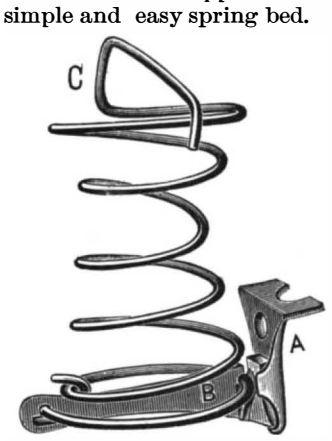
Professor J. Harvard Biles, of Glasgow University, addressed the members of the Rutland Place (Glasgow) Marine Institute recently on "The Effect on Ship Design of Improvement in Means of Propulsion." Professor Biles, in the course of his lecture, compared the old time propulsion by manual power with the methods in vogue at the present time. One man, he said, on board a modern steamer with all the latest appliances at command, could produce fifteen hundred times as much work as was possible when the power was applied direct. After describing the changes which had been effected in means of propulsion, and pointing out their effect upon ship design, the lecturer proceeded to consider the possibility of propelling ships by lighter machinery and boilers of the tubular type, whose weight would be one-fifth less than at present, and in which oil would replace coal as fuel. Even with such improvements, however, it would take a vessel 1,000 feet in length and 109 feet beam, with engines of 100,000 to 120,000 indicated horse power, to cross from Queenstown to New York in four days. But remembering that in the last fifteen years the propelling power of steamers had been multiplied by six, and that in the present day 30,000 horse power was not unknown, it was not unreasonable to assume that in the next fifteen years the maximum horse power would be quadrupled.

The Magnetic Properties of Oxygen.

Commenting on Professor Dewar's recent experimental verification of the magnetic properties possessed by liquid oxygen, M. Guillaume points out, in *L'Industrie Electrique*, that if we accept the values found by Edmond Becquerel for the magnetic constant of oxygen, it ought, when in the liquid state, and in a field of medium strength, to possess a magnetic moment per cubic centimeter one-third that of iron, and a magnetic moment per gramme twice as great as that of iron; so that the strange conclusion is forced upon us that oxygen is the most magnetic of substances. M. Guillaume also points out that liquid oxygen might be made to give a faithful and delicate representation of the distribution of the lines of force in a magnetic field, the liquid being heaped up in the strong places.

A BED SPRING AND SUPPORT.

The simple and inexpensive device shown in the illustration is adapted for attachment to any ordinary bedstead rail to support the slats and form a cheap, simple and easy spring bed. It has been patented by Mr. Wilbur L. Gillette, of Yalesville, Conn. The base or support of the spring consists of a bracket, A, the wall plate of which rests against and is secured to the inner side of the rail, or the bracket may be secured in the notches where the slats are usually inserted. The main bracket arm, B, has a hole at its outer end and a notch at its inner end in which the bed spring wire is secured, the upper free end of the spring being doubled to form a keeper, C, shaped to easily receive a slat of the bed.



GILLETTE'S BED SPRING.

NOVEL TOYS.

The elasticity of torsion and tension, the storage of energy, centrifugal force, momentum and friction, are all concerned in the movement of the simple toy illustrated in Fig. 1, and yet, perhaps, not one in a thousand of the people who see the toy realizes the composite nature of its action. Barring the well known return ball, nothing can be simpler than this toy, which consists of two wooden balls of the same diameter connected by a slender elastic rubber band attached by staples, as shown in the lower figure.

To prepare the toy for operation, it is only necessary to twist the rubber band by holding one of the balls in the hand and rolling the other round in a circular

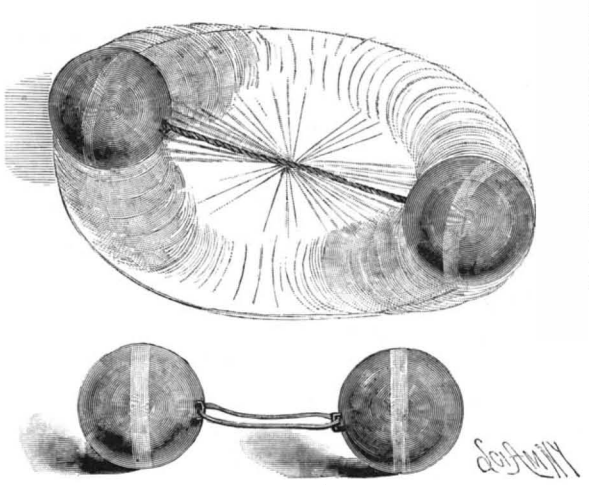


Fig. 1.—GYRATING BALLS.

path upon the floor by giving to the hand a gyratory motion. As soon as the band is twisted, the free ball is grasped in the hand, then both are released at once.

The untwisting of the rubber band causes the balls to roll in opposite directions in a circular path, and centrifugal force causes the balls to fly outwardly. By virtue of the acquired momentum, the balls continue to rotate after the rubber band is untwisted, so that the band is again twisted, but in the opposite direction. As soon as the resistance of the band overcomes the momentum of the balls, the rotation ceases for an instant, when the band again untwisting revolves the balls in the opposite direction, and the operation is repeated until the stored energy is exhausted.

In Fig. 2 is illustrated another ball in which the center of gravity is located near the periphery. The ball, which is hollow, is made of paper. To the inner

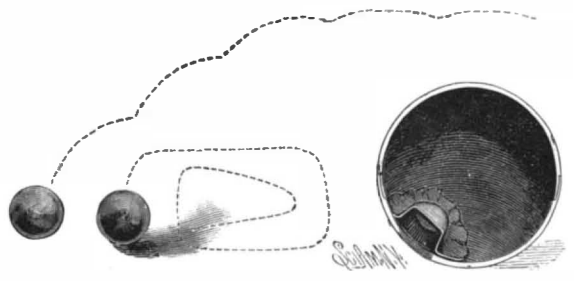


Fig. 2.—UNBALANCED BALL.

surface of the wall of the ball is attached a weight which is secured in place by a piece of cloth glued over it. When this ball is thrown through the air with a whirling motion, it describes a curve like that indicated in dotted lines in the upper part of the engraving, so that it is difficult, if not impossible, to catch it. When the ball is rolled on a plane surface, it does not take a straightforward course, as would be expected from a well-balanced ball, but its course is very erratic, as indicated in dotted lines in the lower part of the figure.

Bovines vs. Equines.

The differences anatomically and physiologically between the cattle tribe (Bos) and the horse family (Equus) is an interesting study. In parallel tables, as given in the *Maryland Farmer*, these can be seen at a glance:

CATTLE.	HORSES.
Have two toes.	Have one toe.
Horned.	Without horns.
Have no mane.	Have flowing mane.
Long hair in a tuft at end of tail.	Tail covered with long hair.
Pawing with fore feet denotes anger.	Pawing with fore feet denotes hunger.
Seize forage with the tongue.	Gather food with the lips.
Lips slightly movable.	Lips very movable.
Have no upper incisor teeth.	Have upper and lower incisors.
Lie down fore parts first.	Lie down hind parts first.
Rise on hind legs first.	Rise on fore legs first.
Short mouth. No space between incisor and molar teeth.	Mouth long. Space between front and back teeth.
Four stomachs.	One stomach.
They chew the cud.	Do not chew the cud.
Intestines small—120 feet long.	Intestines large—60 feet long.
Have gall bladder.	Have no gall bladder.
May vomit.	Do not vomit.
May breathe through the mouth.	Don't breathe through the mouth.
Mouth generally open when wearied.	Mouth never open from exhaustion.
Defense by goring.	Defense by kicking.
Bellow or moo.	Neigh or whinny.
Do not sweat.	Perspire easily.
Have dewlap.	Have no dewlap.
No warts on inside of hind legs.	Hard, oval warts inside hind legs.
Never use teeth in fighting.	Use the teeth in fighting.
Do not retract the ears.	Retract the ears when angry.
Very rough tongue.	Soft, smooth tongue.
Short, broad head.	Long, narrow head.
Wide, drooping ears.	Erect, narrow ears.
Limbs formed for strength.	Limbs formed for speed.
Live twelve or eighteen years.	Live thirty or forty years.
Do not roll in the dust.	Do roll in dust.
Sleep with both ears alike.	Sleep with one ear forward.
Lie down to sleep.	Often sleep standing.
Eat and lie down to ruminate.	Never ruminate. Eat little and often.
Shoulders straight.	Shoulders sloping.

The Iron Industries thinks men who attend to the lubrication of moving machinery ought to make a study of the action of various oils upon metals more than they do. Recent experiments show the following interesting results: Iron is least affected by seal oil and most by tallow oil. Lead is least affected by olive oil and most by whale oil; whale, lard and sperm oils act to very near the same extent on lead. Brass is not affected by rape oil, least by seal oil, and most by olive oil. Tin is not affected by rape oil, least by olive oil and most by cotton seed oil. Zinc seems not to be acted upon by mineral lubricating oils, least by lard oil and most by sperm oil. Copper is not affected by mineral lubricating oils, least by lard oil and most by tallow oil. Mineral lubricating oil has no action on zinc and copper, and acts the least on brass and most on lead. Olive oil acts least on tin and most on copper. Rape oil has no action on brass and tin, acts least on iron and most on copper. Tallow oil acts least on tin and most on copper. Lard oil acts least on zinc and most on copper. Cotton seed oil acts least on lead and most on tin. Sperm oil acts least on brass and most on zinc. Whale oil has no action on tin and acts least on brass and most on lead. Seal oil acts least on brass and most on copper. From these results it will be seen that mineral lubricating oil has, on the whole, the least action on the metals employed in the experiment, and sperm oil the most. For lubricating the journals of heavy machinery, either rape oil or sperm oil is the best to use in mixture with mineral oil as they have the least effect on brass and iron, which two metals generally constitute the bearing surfaces of an engine. Tallow oil should be used as little as possible, as it has a bad effect on iron.

The Transformations of the Digger Wasps.

At a recent meeting of the Entomological Society, of Washington, Professor Riley gave a detailed description of the larva of our larger digger wasp (*Sphecius speciosus*), and drew attention to a remarkable peculiarity of the cocoon of this insect. This peculiarity consists in the presence of certain very anomalous pores which occur about the center of the cocoon and extend nearly around it. These, Professor Riley stated, must be intended for some special purpose, and probably for ventilation or respiration.

The occurrence of these pores, he stated, brings up the interesting question of the need of ventilation in the cocoons of hibernating insects, and he believed, in general, that in proportion to the imperviousness of the cocoon to air, some provision for its admission would be found.

Ticking of the Death Watch.

Mr. C. J. Gahan, at the meeting of the Entomological Society, of London, for December 2, 1891, exhibited specimens of the common book louse (*Atropos pulsatorius* Fabr.), which he had heard making a ticking noise similar to that made by the "death watch" (*Anobium*). We put this on record as corroborative evidence of the power of making such noises possessed by atropos, which many have felt doubtful of on account of its minute size and soft body covering.

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Correspondence.

The Aurora.

To the Editor of the Scientific American:

There was a bright aurora on the night of Saturday, April 23. This display is of special interest, because it is the sixth successive recurrence at the precise interval of twenty-seven days, the dates being as follows: December 9, January 5, February 2, February 29, March 27, and April 23. This period corresponds to the time of a revolution of the sun as viewed from the earth, or, in other words, a synodic revolution. Upon each of these dates, also, there was at the sun's eastern limb a disturbed area located south of the equator appearing by rotation. In like manner a record now before me shows that disturbed areas in the sun's northern hemisphere are attended by the appearance of the aurora when coming into view by rotation, but that this is the case in the autumn months instead of in the spring. Now, in the autumn the north pole of the sun is inclined toward the earth and in the spring the south pole is thus inclined, and the sun spots are invariably located within the limits of a narrow belt on each side of the sun's equator and at comparatively a short distance from it. Thus it appears that, in order that a solar disturbance may have its full effect upon the magnetism of the earth and produce an aurora, it must be in a particular location, namely, at the eastern limb, and as near as possible to the plane of the earth's orbit.

M. A. VEEDER.

Lyons, N. Y.

Patent Office Examinations.

To the Editor of the Scientific American:

Referring to your suggestions under the head of "A Proposed Congressional Resolution Relating to Patents," v. 66, p. 256, I would suggest that, as it does not appear to me that "examinations may readily be made by any skilled person" outside of Washington, or even of the examining force of the Patent Office, it being difficult to make exhaustive examinations even inside of the office, it would not be well to dispense with official examinations; but that the injury to the public resulting from delays in deciding interferences would be obviated by a law providing that, when interfering applications were ready for issue, a patent for the invention involved should be deposited in court, to date from day of deposit, and the rival claimants should prosecute their claims in court, as in the case of dispute over the ownership of money paid for condemned land or any other property deposited in court. The interests of the contestants would then be in the direction of a speedy settlement, while the public could not in any event be made to suffer by delays.

B. PICKMAN MANN.

1918 Sunderland Place, Washington, D. C.,
April 23, 1892.

[Our correspondent thinks it would be wise, in the case of interfering applications for patents, to issue the patent and have the question of priority settled by the court. In this we agree with our correspondent. Our suggestion goes a step further. We proposed the issue of patents to all applicants, leaving the question of novelty and validity to be settled by the courts, and removing it altogether from the Patent Office. If it is desirable to do this in interfering applications, it is equally so for all applications.—Editor SCIENTIFIC AMERICAN.]

The Fair to be Dedicated October 12.

A Congressional investigating committee visited Chicago the first week in April, and it is said its members were astonished to see the vast amount that has been done during the last few months. All but three or four of the fifteen largest buildings are under roof, and even the vast manufactures building, which covers over thirty acres of ground, is rapidly advancing toward completion. The much discussed subject of the nature of the dedicatory ceremonies next October has at last been settled, and the general features of the ceremonies, as now decided upon, are as follows:

On October 12 there will be a national salute, and, in the early part of the forenoon, the troops, both of the regular army and the national guard, will be assembled under the command of Gen. Nelson A. Miles, U. S. A., and will be reviewed by the President of the United States at 11 A. M. Immediately after the review the ceremonies proper will be held in the great manufacturers' building. They will consist of (1) a march for the orchestra, composed especially for the occasion by John K. Payne; (2) a prayer by the Methodist Bishop, Charles H. Fowler, of California; (3) presentation by the chief of construction, Mr. Burnham, of the master artists of the exposition and their completed work; (4) report by the director-general of the exposition, Col. George R. Davis; (5) presentation of the buildings to the president of the national commission by the president of the local directory; (6) vocal chorus, "The Heavens Are Telling," Haydn; (7) presentation of the buildings to the President of the United States by the president of the national commission; (8) march and chorus from "The Ruins of Athens," Beethoven; (9) dedication of the buildings by the President of the United States; (10) hallelujah chorus from "The Messiah," Handel; (11) dedicatory oration, by Hon. W. C. P. Breckinridge of Kentucky; (12) dedicatory ode, words by Miss Harriet Monroe, music by Prof. Chadwick; (13) "The Star Spangled Banner," and "America," with grand chorus and full orchestral accompaniment; (14) national salute. In the evening there will be a magnificent display of fireworks, and the grand allegoric parade, the "Procession of the Centuries." The next day, October 13, will be devoted to receptions, military maneuvers and a grand dress parade of all the troops, with more pyrotechnics and a repetition of the allegoric "Procession of the Centuries." The foregoing programme has been approved by the national commission and concurred in by the local directors. Director-General Davis will be master of ceremonies, and Gen. Miles chief marshal. Seats in the manufactures building will be provided for all invited guests. No admission fee will be charged to the grounds on October 12, the first day of the ceremonies, until 5 P. M., after which, and during the next day, fees will be charged.

Collecting and Recovering Waste Rubber.

BY I. A. SHERMAN.

The business of securing waste rubber and recovering it obtained its impetus soon after the expiration of the Goodyear patents. Before that time the scrap, particularly that which was vulcanized, had been burned under the boilers or thrown away. The old Hayward company made a road through a swamp of heel trimmings and other vulcanized scrap. A quantity which would now be worth many hundreds of thousands of dollars has been dumped over the docks or buried in the ground to get it out of the way. As the manufacture of rubber increased in importance, and natural competition became more severe, the price of crude rubber constantly appreciated. The inventive faculty of the manufacturer was exercised, therefore, to find various ingredients and adulterants that would make the goods cheaper. Of all the materials used in rubber compounding, none was found to be as effective as recovered rubber, and this for the simple reason that when carefully prepared it *is* rubber. There are those who think, in buying rubber goods, that any percentage of "shoddy" in the compound is a disadvantage. If these people were aware that mould work of the lower grades is often made of shoddy with no addition of pure rubber, they would perhaps awaken to the fact that a certain percentage of this same shoddy would be far better in good goods than would an equal or perhaps larger amount of whiting or lampblack. It is true, however, that while the amalgamation of waste rubber with pure gum is an advantage, it can reach a point where it becomes a positive injury to the goods and to the trade, and a permanent source of annoyance for both manufacturer and retailer.

The purchaser of a pair of rubber shoes apparently can see little difference between that which costs twenty-five cents and that which may cost $1.25 a pair, and the most eloquent salesman finds it difficult to point out the difference. On the other hand, if goods were made entirely of pure gum, they would be too elastic and would draw the feet, besides being so costly that the ordinary consumer could not afford them. It is by the most careful working of waste with "live" material that the best goods are obtained at a price that any one can reach. The abuse comes in when the maker, forced by competition, allows his cupidity or embarrassment to obtain the better of his judgment and to so load the goods with shoddy that they have little or no wear. The career of the rubber car spring business is a good illustration of this sort of folly. It is acknowledged that there is no better material in the world for car springs than rubber, and to-day the railroads would be using little else had the manufacturers kept up the quality of the goods. In an evil hour, however, they began to cut prices, and to do this without loss they were forced to lower the quality of the goods. This was kept up until the railroad men became disgusted, and, as a whole, gave up the rubber spring. To-day its use is chiefly among electric men, and those who made a specialty of rubber car springs have turned their attention to other specialties.

Waste rubber is gathered in all sections of this country and also in Europe, although more is gathered in the United States than abroad. This is perhaps because the people in this country are far better shod than those in other countries. The familiar Italian in New York City, with hook and bag, who prowls around the morning ash barrel, is the pioneer in this collection of bits of waste rubber. He selects the old shoes and occasional water bottles, and sometimes a rubber waterproof, and takes them all to a junk dealer, who in turn delivers them to the dealers of higher degree. Many of the rubber mills also have quantities of vulcanized scrap that they sell to those who make the business of grinding and recovering. The wholesaler of rubber scrap classifies his goods as follows: Pure, two qualities of white, boots and shoes, springs, packing, hose, red rubber, and unvulcanized rubber. Of the scrap that is thus gathered by far a large proportion of it is old boots and shoes. These are sorted roughly, put up in bales, and shipped to the companies who make a business of reclaiming.

Briefly described, the process of reclaiming old rubber boots and shoes is as follows: By the mechanical process the boots and shoes are thrown into a machine known as a "cracker," and are roughly torn to pieces, the workman picking out any pieces of brass that he may see. From this they go to a grinding mill with a very decided friction motion which grinds the product to a fine powder. It is then passed through an air blast to remove the fiber, and the black powder is then run over a machine fitted with a series of magnets, which removes the iron. It has been found that grinding waste rubber in water greatly increases its life, which opens up a field for interesting experiment on the part of rubber men. The black powder is next put in iron pans, run into a vulcanizer and exposed to live steam for a number of hours at a temperature varying from 400° to 600° F. The steam heat volatilizes the sulphur, whence the term "devulcanization." When the shoddy is taken out of the vulcanizer it may be put on a grinder, when it will readily form in sheets, and has very much the appearance of compounded stock that is unvulcanized. A more modern process and one that gives excellent results is what is known as the acid process. In this, instead of removing fiber by the air blast, it is destroyed by a weak acid solution in which the shoddy is boiled. Of course, for various kinds of rubber work there would be other shoddies than the boot and shoe shoddy; for example, hard rubber sawdust and turnings are used largely in hard rubber work, and pure gum is often ground to a fine powder and used in stock that is to be very springy. Pure rubber, however, cannot be easily devulcanized. There are also those who make a business of purchasing the unvulcanized scrap from rubber clothing manufacturers, soaking the cloth in benzine, peeling off the rubber, and selling it back to the manufacturers.

The business of gathering shoddy is a large one, and the transactions involve contracts of two and three hundred tons a season for a single manufacturer. Shipments are often made as large as fifty and sixty tons at a time. It will hardly be just to say that all rubber manufacturers use shoddy, for they do not. There are, however, few lines of goods in which recovered rubber cannot be used, and that, too, with a certain advantage. In no line of business is there more system than in the recovered rubber business. Practically the waste out of an ash barrel is as free as the water in the river. At the same time it costs even to collect it. After the rough work of gathering is over the steps in manufacturing are most carefully planned, and until it reaches the factory where it is to be used there is no chance for exorbitant profit in any of the processes of manufacture. So close is the competition that oftentimes the rate of freight will spoil the trade of certain factories. Taken as a whole, the business is a peculiar and not particularly pleasant but exceedingly important one.—*Rubber World.*

Friction of Lubricated Bearings.

At the meeting of the Leeds Association of Engineers on February 25, Mr. J. H. Wicksteed read a paper on the "Friction of Lubricated Bearings," founded on the researches of the Institute of Mechanical Engineers. After describing the apparatus used, the author began the discussion of the results arrived at, which he stated confirmed the deductions drawn from ordinary practice. With careful lubrication steel shafts running in gun metal bearings at from 50 to 300 revolutions per minute would seize with the below mentioned loads: Collar bearings, 100 pounds per square inch; footstep bearings, 200 pounds per square inch; cylindrical bearings, at 600 pounds per square inch; while a pin working intermittently will stand about ten times the above pressure without seizing. In all the experiments the surface was taken as being the diameter by the length. The lecturer pointed out that in the friction of solids, the friction is directly proportionate to the load, while with liquid friction, *i. e.*, with a perfect lubrication where a film of liquid intervenes between the metallic surfaces, the friction is independent of load. The experiments showed that in a bearing with the load applied above, as in rolling stock, there was an upward pressure of more than 500 pounds, a hole being bored in the crown of the journal, and a pressure gauge inserted showing as much as 600 pounds pressure per square inch in a bearing 4 inches in diameter by 6 inches long. Thus a total pressure of upward of 6 tons was supported by fluid pressure of the lubricant, which pressure did not fall appreciably for half an hour after the experiments ceased. This film of oil would not exceed one ten-thousandth of an inch in thickness.

PROF. CHANDLER, of Harvard, has suggested that the variable star Algol—alpha Persei—owes its variableness to the fact that, together with a dark satellite, it revolves round a third and central body, which is also dark, in one hundred and thirty years. The orbit of the shining star Mr. Chandler calculates to be two thousand five hundred times as large as that of the satellite.

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THE NAVAL GUN FACTORY, WASHINGTON.

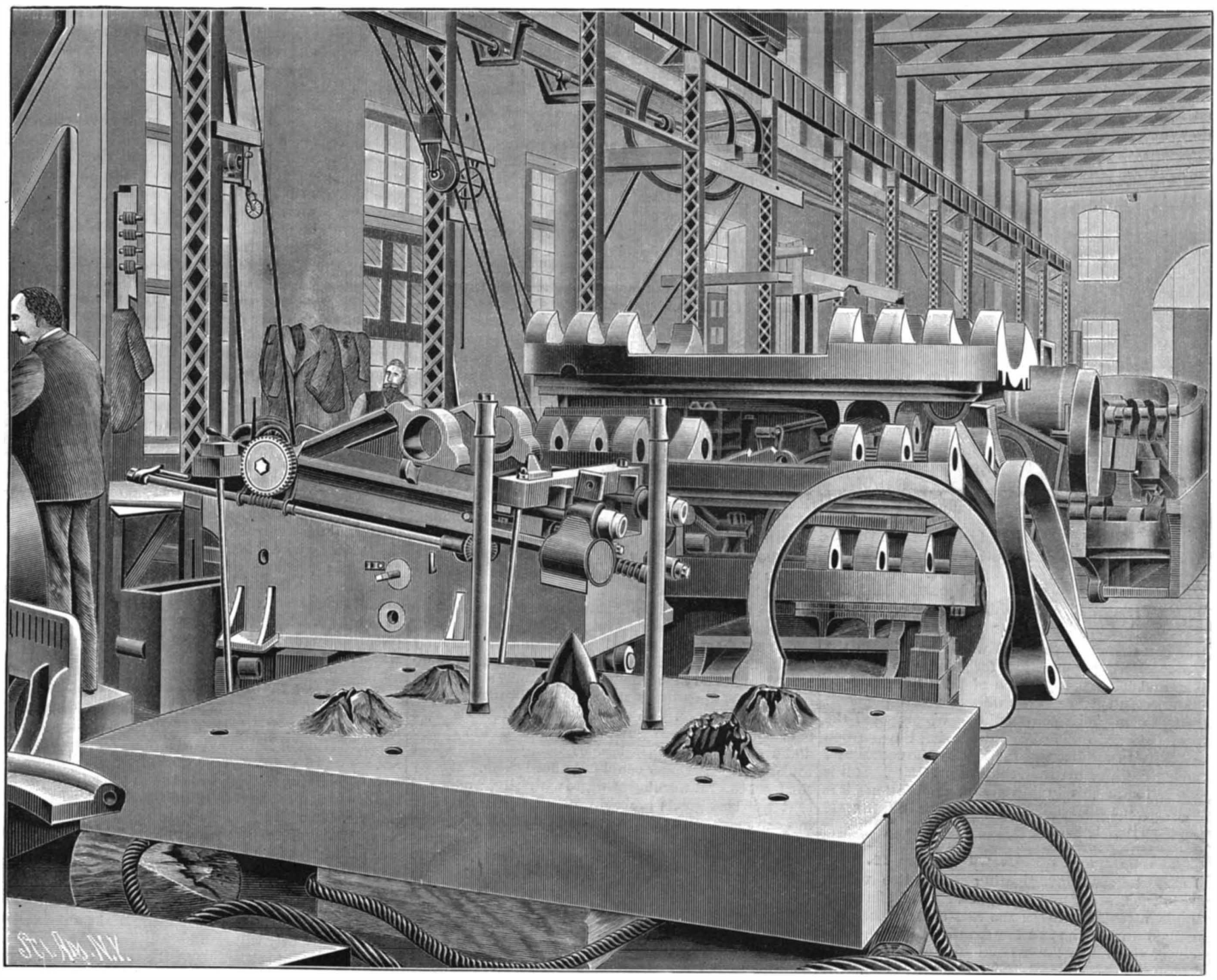
(*Continued from first page.*)

turn in twenty-five calibers. The number of grooves for the various classes is four times the caliber of the gun in inches; their width for the larger guns is a little less than half an inch and their depth about five one-hundredths of an inch.

The breech is closed by a steel cylinder or breech-block, having a screw thread on its outer surface. The circumference of the block is divided into six equal parts, and from three of these, alternating with the others, the threads are cut away longitudinally. A corresponding thread, similarly cut away, is made in the prolongation of the bore, at the breech of the gun; and thus, when the block is pushed into its place, a sixth of a turn to the right locks it.

The time required to make one of these modern guns, notwithstanding all the facilities which have been provided for the work, is considerable. A 4 inch gun, after its separate parts have been received from the manufacturers, cannot be "assembled" in the factory within less than fifty days, and 5, 6, 8, 10, 12, and 13 inch calibers require respectively 55, 60, 105, 150, 270, and 360 days for their completion. The plant of the factory, however, permits work upon a considerable number of guns to be in progress at the same time, and its capacity for production can be quickly and greatly increased in an emergency. But, slow as is the process of gun construction, that of building ships of war is still slower; so that the Washington gun factory is regarded as amply able to supply our new vessels with their batteries as soon as they shall be ready to receive them.

The 12 inch guns of the Monterey weigh 45 tons each, and each is 37 feet long, the firing charge being 425 pounds of powder, with a shell weighing 850 pounds. The 13 inch gun weighs 60½ tons, using 550 pounds of powder, with a shell weighing 1,150 pounds.



THE NAVAL GUN FACTORY, WASHINGTON—AN ARMOR PLATE AFTER TESTING.

Cure for Snake Bite.

The April number of the *Therapeutic Gazette* contains reports of several cases of deadly snake bites which were cured by hypodermic injections of strychnine. It seems to be almost a sovereign remedy.

How to Get Rid of Household Pests.

In a lecture before the Lowell Institute Prof. Riley discussed the ever timely subject of household pests. The treatment of the subject was practical, and the remedies given for each particular pest are worth noting by the careful housewife. For certain of the commoner pests, such as the bedbug, the carpet beetle, the clothes moth, benzine applied in a fine spray by means of a hand atomizer was stated to be the best remedy, as in most cases it destroys the insect in all stages, including the egg. In using benzine, however, care must be taken that no fire or artificial light is in the room at the same time, the vapor of benzine being highly explosive. For cockroaches, bristle tails, or fish moths, and fleas the lecturer recommended a liberal use of pyrethrum powder, in the form of either Persian or Dalmatian powder, or buhach. Fleas, he said, are generally introduced into houses by dogs or cats, and the presence of bed bugs is not always a sign of uncleanliness, as they have been found under the bark of trees in the woods, and in country houses may sometimes be traced to this source. Keeping premises clean and dry was said to be in general a good preventive of insect pests.

The common house fly, with its complicated mouth and its stereoscopic eyes with 4,000 facets, was next discussed, and the lecturer then passed to an interesting account of the mosquito. The eggs of this insect are laid in the water, and the larva, when hatched, passes through several moults in the same element, the perfect mosquito finally breaking out from the pupal skin and flying away on her bloodthirsty mission. The female mosquito is the form which stings, the male seldom leaving the swamps where he dwells, and contenting himself with vegetable juices. In dealing with the mosquito as a household pest, good pyrethrum powder is probably the best preventive of its annoyances. Moistened and made into little cones, allowed to dry, and then burned in a closed chamber, this powder will either stupefy or kill, and is one of the best means of freeing chambers from mosquitoes. Touching upon a theory advanced some years ago—that mosquitoes by their stings inoculate the body with malarial poison—the lecturer stated that in his judgment there was no connection between the two, though the same conditions which cause malaria are apt also to breed mosquitoes. In the case of elephantiasis, however, a disease prevalent in tropical countries, and due to a minute organism known as filaria, it has been well established that the filaria in its life development must needs pass through the mosquito as an intermediary host. —*Boston Advertiser.*

The Composition of Resin Oil.

Mr. F. H. Leeds finds that resin oil of the first distillation varies considerably in its composition, according to the design of the stills and the consequent greater or less ease with which the resin can volatilize unchanged during distillation. The acidity of commercial samples varies from 15–24 per cent, the molecular weight of the acids being assumed to be 302. The acidities quoted above are those given by titrating an alcoholic solution of the oil with caustic alkali. By boiling the oils with excess of caustic potash, and titrating back, a further consumption of alkali takes place, a difference varying from 1–9 per cent being noted. Long exposure of the oil to the air produces little change in the percentage of acids found by direct titration, but leads to a marked decrease in the additional portion that is only saponified by boiling with an excess of caustic alkali. It further appears, from the non-agreement of the volumetric and gravimetric determinations of saponifiable matter, that the molecular equivalent for the acids quoted above is not accurate.

THE Treasury Department has lately issued a circular reciting the various articles of American production that may now be introduced either free of duty or greatly reduced duties in Brazil, Spain and colonies, San Domingo, Salvador, Great Britain, and Germany. The list is a large one and embraces many of our principal agricultural productions, machinery, and articles of manufacture. In due time these new commercial treaties probably will give a new impetus to our foreign trade. The country needs now more than ever the establishment of lines of fast steamers from these shores to the countries above named.

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THE NEW CRUISER RALEIGH.

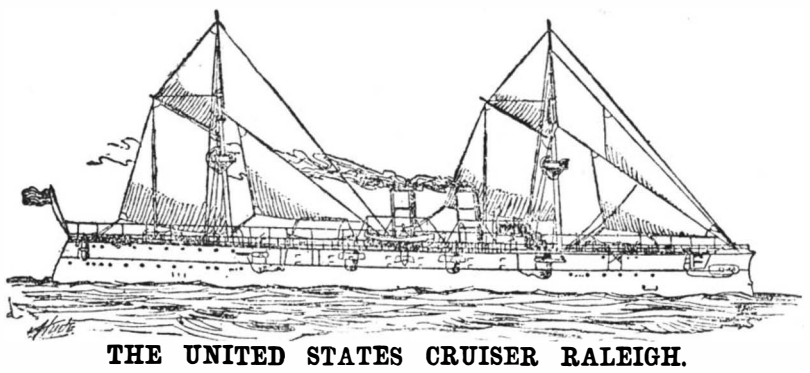
The cruiser Raleigh was launched at the Norfolk navy yard March 31, in the presence of many thousand spectators. Besides the great throng in the navy yard itself, the shores of the river were lined for a long distance, and dozens of steamers, tugs, and yachts were crowded with spectators.

We give an engraving of the launch, prepared from a photograph of the scene, for which we are indebted to Mr. J. H. Faber, photographer, Norfolk, Va.

Naval Constructor Bowles had charge of the work.

One circumstance which added to the interest was that the Raleigh was ready so much in advance of her sister ship, the Cincinnati, now under construction at the Brooklyn navy yard.

The signal was given at 11:36 A. M., and Mrs. Alfred W. Haywood, of Raleigh, N. C., daughter of Governor Holt, of North Carolina, standing between the Secretary of the Navy and Ensign Hilby P. Jones, broke the bottle of wine on the bow of the cruiser, which began to move off as easily as if under her own propeller. Just three-quarters of a minute from the time the bottle was broken the Raleigh was stopped by her anchors in midstream. Governor Holt and staff, the volunteer soldiery of this section, and many prominent people from a distance were present.



THE UNITED STATES CRUISER RALEIGH.

By act of Congress, approved September 7, 1888, the construction of two steel cruisers of about 3,000 tons displacement each, to cost not more than $1,100,000 each, exclusive of armament and any premiums that might be paid for increased speed, was authorized. The speed prescribed was 19 knots, with a premium of $50,000 for each quarter of a knot additional, and the same deduction for each quarter of a knot deficient. The act authorized the Secretary of the Navy to build the vessels in navy yards if unable to contract for them at reasonable prices.

Proposals were advertised for, but none within the limit of cost fixed by Congress was received. The Secretary, accordingly, directed that the vessels to be known as cruisers Nos. 7 and 8 should be built at the navy yards at New York and Norfolk, respectively. The chief constructor gave orders to begin work on No. 8 on September 26, 1889. The first keel plate was laid on December 19, 1889. Since then the work has been carried on as expeditiously as possible against the difficulties of training a new force of workmen and vexatious delays in the delivery of material. In pursuance of the plan of naming second class ships after cities, the President decided that cruiser No. 8 should be called the Raleigh.

The Raleigh has a length of 300 ft. on the load water line, and an extreme breadth of 42 ft. At her mean normal draught of 18 ft. of sea water her displacement is about 3,180 tons, the maximum draught then being about 19 ft. She will have two sets of engines working twin screws, and develop (estimated) 10,000 indicated horse power at full power with a steam pressure of 160 pounds. This will drive the ship at 20 knots. Her coal supply at normal draught will be 400 tons. The bunkers will hold 675 tons, and with this supply she can steam 1,500 miles at full power, or 10,500 at 10 knots, her most economical speed.

The engines are of the triple-expansion, vertical, inverted, direct-acting type, with two low-pressure cylinders. Her cylinders are 36, 53, 57 and 57 in. in diameter, with a common stroke of 33 in. Steam is supplied by four double-ended boilers and two single-ended ones, to be used as auxiliaries. The grate surface is 597 sq. ft. and the heating surface 19,382. The closed ash pit system of forced draught will be used. The condensers have each 7,000 sq. ft. of cooling surface. The revolutions at full power will be 164.

The main and auxiliary engines occupy four watertight compartments, and the boilers four others. The watertight subdivision at the ends of the ship is very complete. The protective deck is 1 in. thick on the flat, 2 in. at the slopes at the ends, and 2½ in. on the slopes amidships. A cofferdam to be filled with woodite or cellulose extends around the ship in the wake of the water line, on the protective deck. The ship has poop and forecastle decks, with an open gun deck between, and bridges extending along the top of the hammock berthings connecting the poop and forecastle. The rig is that of a two-masted schooner, spreading 7,210 sq. ft. of sail. The boats are stowed on skid beams between the two fore-and-aft bridges.

The main armament consists of one 6 in. breech-loading rifle mounted on the forecastle and having an arc of train of 270 degrees from quarter to quarter, ten 5 in. rapid-fire guns, two mounted on the poop and the others on the gun deck in sponsons; those on the poop and the after two on the gun deck train from right astern to 60 degrees forward of the beam; the two forward ones on the gun deck train from right ahead to 60 degrees abaft the beam; the others train 72 degrees before and abaft the beam. The auxiliary armament consists of eight 6 pounder rapid-fire guns mounted, four over the forward and after sponsons on forecastle and poop, two on gun deck forward and two on gun deck amidships; four 1 pounders mounted, two on gun deck aft (in captain's after cabin) and two on bridges; two Gatlings mounted in the tops. The forward and after 5 in. guns on the gun deck are protected by 4 in. armor. The other sponsons have 1 in. armor plates. The conning tower will be 2 in. thick, as will the tube leading from it to the protective deck. There are six above-water torpedo tubes; fixed ones ahead and astern and training ones on each bow and quarter. The tubes are of the Howell pattern, using gunpowder to project the torpedo.

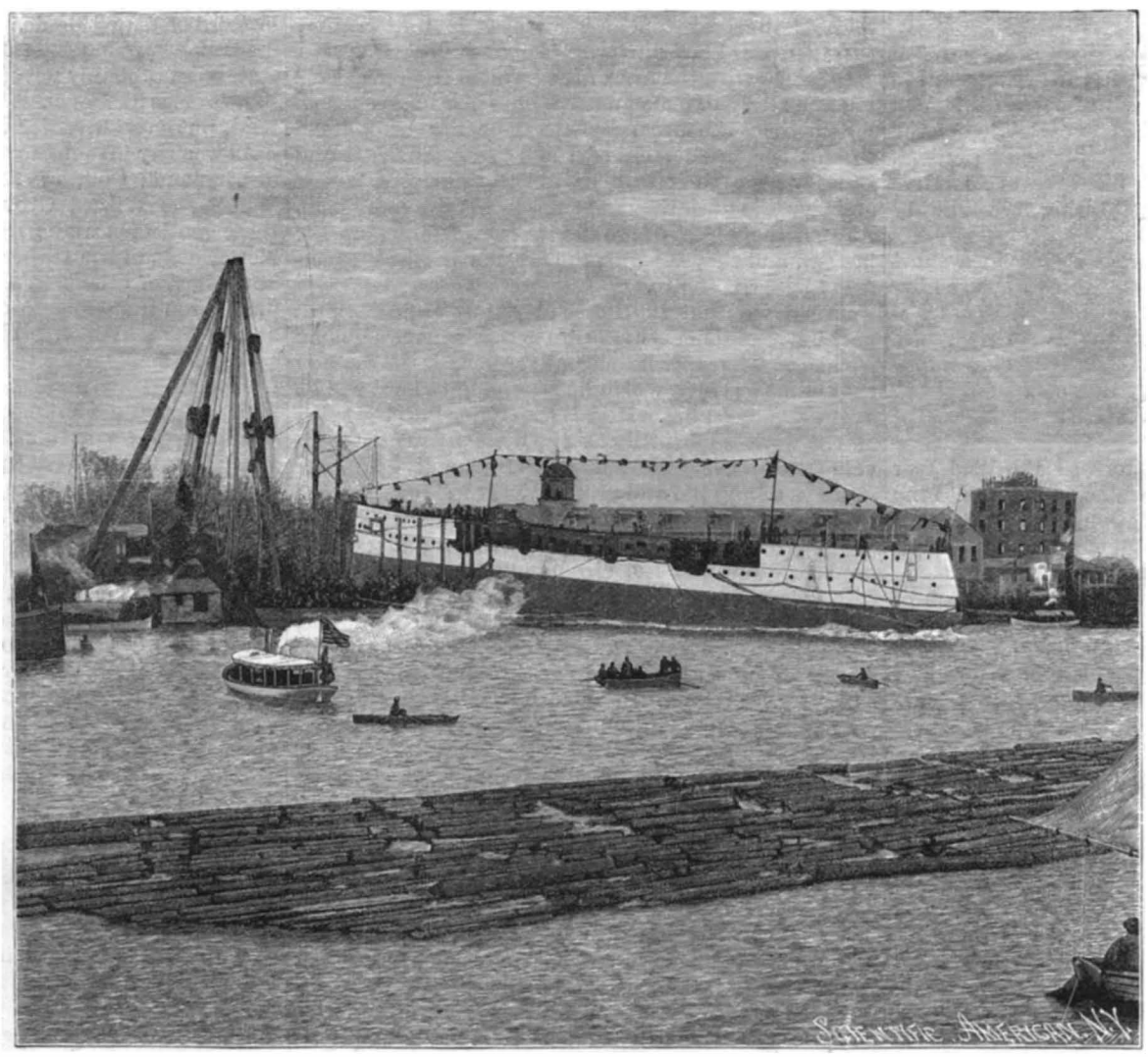
The ship will be lighted by electricity, the plant consisting of two engines and dynamos, each with an output of 200 amperes at a constant potential of 80 volts. In addition to all necessary lights for illumination and signaling, there will be three Mangin searchlight projectors. The lights will be arranged in sections, on independent conductors, all controlled by a switchboard in the dynamo room, so arranged that either of the dynamos can be put on any or all of the arc or incandescent circuits.

The engine power of the Raleigh is relatively greater than that of any other vessel of the United States navy, except the Vesuvius and the torpedo boats, occurring, as it does, in conjunction with a larger battery power, necessitating a larger crew. The complement will be about 320; 24 officers, 34 marines, and a crew of 266. The rudder is partly balanced. Its weight is about 7·5 tons. The ordinary right and left steering gear is used, actuated by a powerful steam steering engine below the protective deck.

It is estimated that her cost completed, including armament and equipment, will be $1,642,915.74.

The actual weight of the ship when launched was 1,140 tons.

The Raleigh is the first vessel of the new navy to be built complete by the government, as the machinery and boilers are under construction and now nearly completed at the navy yard at New York.



LAUNCH OF THE NEW WAR SHIP RALEIGH, AT NORFOLK, VA.

Census of the Carrier Pigeons at Paris.

The enumeration of the carrier pigeons at Paris prescribed by a law of 1877 shows that the number of pigeons and owners is yearly increasing in a very sensible proportion. In 1890, the census gave the following figures:

Owners, 608; trained pigeons, 6,619; untrained, 6,658; say a total of 12,277.

In 1891, the census gave:

Owners, 697; trained pigeons, 7,012; untrained, 6,977; say a total of 13,989.

These figures, put in comparison with those of the preceding year, represent an increase of 89 owners and 1,712 pigeons. The census of carrier pigeons does not concern itself solely, as for horses, with the gross number of the birds, but is completed by a serious inquiry into the subject of mortality, and the military situation of each owner of carrier pigeons, and into the direction in which his pigeons are trained, so that at the moment of a declaration of war, the military authorities, on taking possession of the cotes, may be able to utilize the pigeons at once. This inquiry permits also of detecting owners who are in contravention for false declarations or for want of authorization.

The great majority of the breeders are of French nationality. There are, however, a certain number of foreigners among them, say twenty-seven Belgians, one Russian, one Spaniard, one Swiss, one Austrian, and four Germans.

The arrondissement of Paris that contains the largest number of owners of pigeons is the twentieth; after this come the eleventh, nineteenth and thirteenth. The arrondissement containing the smallest number is the third, in which there are but three owners, who possess, in all, twenty-four pigeons. — *Colombiers Militaires en Europe.*

The Sampson Well at Waco, Texas.

The "Sampson" is the largest well in the United States, and has few rivals in the world. It is bored with a diameter of 10 inches to the depth of 1,850 feet—all the artesian wells of Waco finding their supply at from 1,825 to 1,850 feet deep. The "Sampson" throws up about 1,500,000 gallons daily of hot but perfectly pure and crystalline water, at a temperature of 103°—which is the highest temperature of any artesian water yet discovered—with a pressure of 60 lb. to the inch. It will rise in the standpipe to the height of 120 feet from the ground. The supply appears to be inexhaustible, no diminution of pressure having so far been felt at the other wells. Besides the "Sampson" there are two other standpipes, respectively 80 by 20 feet and 88 by 20 feet, which not only supply Waco with pure artesian water for domestic and manufacturing purposes, but also for hot, swimming, and other baths. More important still, indeed, for the future of the city, these supply it, in addition, with a motive power which can be applied to all kinds of manufacturing purposes.

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Natural History Notes.

Cats in Egypt.—The first people known to have domesticated cats were the ancient Egyptians, on whose monuments representations of these animals are found as early as 1600 B. C. It is on a tomb erected about 1300 B. C. that the cat first appears unmistakably as a domesticated creature, being shown seated beneath a chair. In ancient Egypt, the cat was an object of religious worship, and was even an inmate of the temples. There was actually a cat goddess, named Bubastis, who was always depicted as having a cat's head. Behind the templ dedicated to her at Beni Hassan, great pits have been found containing multitudes of mummies of cats.

The cat was also regarded as an emblem of the sun, its eyes being supposed to vary in color with the progress of that luminary through the heavens. Likewise its eyes were believed to undergo a change each lunar month, and for this reason the animal was also sacred to the moon.

The Mudfish (*Protopterus*).—Travelers in Central Africa, during the hot season, often follow the dry beds of rivers and creeks for miles to obviate the necessity of cutting their way through the heavy jungles which everywhere abound. Africa is well known to be the native land of many extraordinary things, animate as well as inanimate. This being the case, the first explorers paid no attention to the thousands of balls of hardened mud which were strewed about in profusion in the beds of these dried-up streams. One day, however, when a detachment of the Cameron expedition was exploring what in the wet season would have been a tributary of the Nile, a woodman cracked one of the balls and was surprised beyond measure to see a live fish-like animal fall out of the center of the ball and flounder in the sand.

This curious discovery led the explorers to make an investigation, whereupon every hardened ball of earth was found to contain a specimen of the same animal. These spherical mud dwellings, which, on account of their likeness to the cases made by several species of insects and worms, have been called cocoons, are perforated with many small holes and lined with a mucus from the animal's body, the mucus keeping the dried ball damp upon the inside, and the holes being used for breathing purposes. For want of a more euphonious name, this queer animal has been dubbed the "mudfish," which is expressive of the creature's curious habits.

The remarkable instinct which causes the mudfish to roll itself in a ball of mud when the dry season approaches is a wonderful provision of nature intended solely, it would seem, to prevent the extinction of the species. The most interesting fact about this animal is that it breathes by means of gills when in its native element, and by means of lungs during its voluntary imprisonment in the mud cocoon.

The Dinornis.—Mr. H. O. Forbes states, in a short note in *Nature*, that he has been able to assure himself from some particularly well preserved bones discovered in New Zealand that the *Dinornis* really possessed a rudimentary wing. The coracoido-scapular, in fact, has a rounded cavity that could only have been a glenoid cavity that received a humerus of some size.

Some Curious Lobsters.—Visitors to Portland Pier who happened one day not long since to drop into the lobster house of Mr. Lewis McDonald were favored with a view of a bright blue lobster which was caught off Cape Elizabeth by a Peak's Island fisherman. The color was decidedly different from the green of the ordinary lobster. On the back the blue was of that deep variety that belongs to indigo, and toward the extremities and under parts shaded off to a fainter but still unmistakable tint, and thence into a pure white. The under part of one of the claws is almost a pure white. The lobster is about eleven inches long. One claw is of full size, while the other is very small. It is said that one other blue lobster has been caught off the Cape this season. Mr. McDonald thinks of preserving the specimen.

He has also a pure white lobster caught about five years ago and preserved in alcohol. Mr. McDonald thinks it is the only pure white lobster ever caught.

Some of those who viewed the blue lobster recalled other queer lobsters that have been seen in Portland. Not long ago Mr. W. S. Trefethen had a lobster that was half green and half red. A straight, perfectly distinct line ran from head to tail along the back of the crustacean. Upon one side of the line the color was a vivid green and upon the other a bright red. The lobster was sent to Professor Spencer Baird, and is now in the Smithsonian.

Feeding Habits of the Elephant.—An elephant's digestive functions are very rapid, and the animal, therefore, requires daily a large amount of fodder—600 pounds at least. In its wild state the elephant feeds heartily, but wastefully. It is careful in selecting the few forest trees which it likes for their bark or foliage. But it will tear down branches and leave half of them untouched. It will strip off the bark from other trees and throw away a large portion.

As it is a nocturnal animal, it selects its trees by the senses of touch and smell. Its sense of smell is so delicate that a wild elephant can wind an enemy at a distance of 1,000 yards, and the nerves of its trunk are so sensitive that the smallest substance can be discovered and picked up by its tiny proboscis.

An elephant's palate is very delicate and the animal is whimsical in selecting or rejecting morsels of food. Sir Samuel W. Baker, in his "Wild Beasts and their Ways," tells an anecdote illustrative of the whims of a tame elephant belonging to the police of Dhubri.

This elephant was fed with rice and plantains. The stems of the plantains were split and cut into transverse sections two feet in length. Three-quarters of a pound of rice was placed within each tube of plantain stem. One day, while the elephant was being fed, a lady offered the animal a small sweet biscuit. It was taken in the trunk and almost immediately thrown on the ground.

The mahout, or driver, thinking that the elephant had behaved rudely, picked up the biscuit and inserted it in a parcel of rice within a plantain stem. This was placed in the elephant's mouth, and at the very first crunch it showed its disgust by spitting out the whole mess. The small biscuit had disgusted the animal, and for several minutes it tried by its inserted trunk to rake out every atom from its tongue and throat.

Fire Horses.

A very interesting story may be told about the horses selected for fire duty in this city. Any one, says *Fire and Water*, who has watched one of the crack engine companies tearing through the street in response to an alarm cannot have failed to notice how the horses strained every muscle to cover the distance as quickly as possible, with scarcely a touch from the driver's whip. Some of the horses show an almost human intelligence.

Nowhere can that be seen better than in the house of engine No. 7, at Chambers and Center Streets, where two horses, Jo and Charley, hold the record for the quickest time in getting into harness. Horses and men have to show off frequently for the benefit of visitors. The foreman sounds the gong in one of these exhibitions, but does not release the horses at once, as the regular alarm does by electrical apparatus. The two big horses, whose stalls are on either side of the engine, strain at their halters and jump in their eagerness to get to their places. The moment the foreman releases them by touching an electric button they spring forward and duck their heads under the collars suspended with the rest of the harness from the ceiling and ready to be fastened about their necks.

Sometimes the foreman snaps the collar beforehand to test the intelligence of the horses. Then Jo and Charley poke their heads through the closed collars and struggle until they get their heads through them. At an actual alarm of fire the horses will start on the instant, and they vie with the firemen in their eagerness to get to the fire.

It is plain that the horse plays just as necessary a part in the autonomy of the fire department as a human member. The more intelligent the horse is the quicker the engine or truck which he is helping to haul will be at the scene of a fire. Horses that enter into the spirit of the work as heartily as the firemen are almost invaluable, for every moment saved frequently counts for much in saving life and property. It follows that the training of the horses which are added every year to the department is as important as the training of the firemen, who must learn to handle the hose, ax, and scaling ladder with expertness. Although that branch of the service is heard of seldom by the general public, Chief Bonner gives it the strictest attention, and the recruits in horseflesh have to go through an ordeal just as severe as that which their human allies must undergo.

The training stables in West Ninety-ninth Street are in a quiet neighborhood, and the new building is used also as the department's horse hospital. Foreman Joseph Shea, who is also Dr. Shea, has charge of the stables. He was graduated as a veterinary surgeon, and has been connected with the department for eleven years. His position is one of the most important in the department. He looks after all the sick horses in the engine houses, and is kept busy at the hospital with the horses laid up there. He buys the green horses for the department, accepting them only after they have shown their ability to do the work required.

The commissioners allow $300 for the purchase of each horse, and Dr. Shea makes his selection from the big bunches of Western horses in the Bull's Head market. He always selects a horse of good size, generally blocky, with plenty of muscle. The horse that has speed and strength in good proportion is the horse that Dr. Shea is looking for constantly.

There are 800 horses in active service in the department, and about fifty recruits have to be added each year. They usually go up to the Ninety-ninth Street stable on trial, half a dozen at a time, and Dr. Shea has a month in which to accept or reject any one or all of the lot. In that time he can tell whether the horse is likely to be of any value.

As soon as the green horses arrive they are housed comfortably in the third story of the stable. Three roomy box stalls are there, too, and their doors indicate hard usage. "Some of these green horses," one of the stablemen said, "don't seem to know anything else but how to kick, and they do that with a vengeance." All of the new recruits do not take kindly to their new quarters, and still less to the training. In the ground story the green horse gets his first lesson. He is usually four or five years old, and barely broken to harness. A part of the story is partitioned off for a tender or hose cart. The customary big fire gong is on the wall, and all of the alarms, from Morrisania to the Battery, are sounded. In stalls beside the tenders the raw recruits are broken in, two at a time. At first they must become accustomed to the sound of the big gong. Most horses are so confused by the clanging that they are absolutely intractable for awhile. Some never get accustomed to the noise, and these are rejected. In the course of a day or two the average recruit begins to understand that it bears a very close relation to his movements.

Wealth in Inventions.

It is an opinion of many that inventors are always poor, but such is by no means the fact. There are poor farmers, poor merchants, poor real estate speculators, poor stock brokers and poor bankers, but by no means are all these operators poor. It may probably be correct that as large or probably a larger proportion of inventors are poor than of any one single class.

One reason probably for this is that gentlemen of wealth are as a class not inventors, specially of those who inherited wealth or a competency. Statesmen and politicians, as a class, are not inventors of useful articles or methods.

Inventors, as a class, are poor men who are desirous of acquiring a competence for support. Very few of them are ambitious for fame. Lawyers are probably the most ambitious of any one class to become distinguished statesmen. But few of them ever become inventors. Nearly every President of the United States went there from his law office. The practice of law qualifies a man for public speaking. We have had a few war presidents like "Old Hickory" Jackson, who defeated Pakenham at New Orleans, and Gen. Grant and Gen. Harrison; but none of these were lawyers, I believe, and I confess were what we might term second or third class presidents. Abraham Lincoln was a self-made lawyer and a self-made statesman, and as a statesman probably never had an equal except possibly Thomas Jefferson. He tried invention of a steamboat, but as an inventor was a pettifogger.

As wealthy inventors we might name Mr. Bessemer, of England; Colt, of the revolver; Howe, Singer, Wheeler & Wilson, Grover & Baker. I think all of these gentlemen were part inventors in their machines. McCormick, of the reaper; and now comes Mr. Edison and a host of others in electric lighting and electric motors too numerous to mention. Most of these are among the millionaires of to-day, while many thousands of others have either a competence or an income from their genius ample to their support.

To manage a meritorious invention to a financial success requires as much skill as to produce it, and many inventors are very poor judges of honest business managers and allow themselves to be swindled out of what they ought to have.

Some years ago a man in Washington told me that he had no brains to invent, but that he watched every invention that came out, and used his skill to make money by other men's brains. The country is always full of this class, and no sooner is a patent issued, whether for a real, meritorious invention or a gimcrack of no value, than the poor inventor is flooded with a lot of literature that pretends to direct him for $10 or $15 to make a fortune out of his wonderful invention. The proper place for all this printed stuff is the fire or waste basket.

If an inventor has a good invention of merit and desires means, the safe way is to go to some acquaintance of means, and he will have no trouble in securing enough to develop it and place it on the market. And I am quite sure that nearly all successful inventors have taken in partners with capital. Occasionally one can be sold out and out for a considerable sum, but these are extreme exceptions. J. E. EMERSON.

The Many-tailed Comet.

Prof. Lewis Swift, of Warner Observatory, reports a dispatch dated San Francisco, quoting Prof. Barnard as saying that his recent observations of the new comet reveal a remarkable state of affairs. Spreading out from the head is a complicated system of tails. At least a dozen distinct branches can be counted on the photograph, some of which present remarkable curvatures.

One telescopic view exhibited the fact that in less than twenty-four hours the third tail had formed to the extent of about 10,000,000 miles, while the northern tail had entirely disappeared. Portions of the tail were seen to form an abrupt angle with their original source.

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RECENTLY PATENTED INVENTIONS.

Engineering.

LINK VALVE GEAR. — William A. Winn, White Hall, Ill. This improved gear permits of a bearing for the outer end of the valve stem to prevent binding of the block in the link, at the same time permitting of the shifting of the link with greater ease. The sliding block has a longitudinal opening through which extends a pivot pin fastened in the sides of the block, there being a valve stem or extension for it holding bearing blocks and engaging the pin, a plate fastening the extension to the stem and holding the bearing blocks in place. The construction is such that the wear of the several parts can be readily taken up, thus preventing lost motion and at the same time reducing friction to a minimum.

MOTOR. — George W. Mings, New Castle, Col. This is a motor adapted to be actuated by the current of a stream, and is more especially designed to operate a pump for irrigating land adjacent, or for placer mining, etc. The invention consists principally of a water wheel mounted one a frame supported on two boats held adjustably one to the other. The frame is pivotally connected with the boats, and means are provided for swinging the boats on their pivots to adjust their front ends that more or less water may pass between them.

Railway Appliances.

CAR BRAKE. — Edward A. Kinley, Breesport, N. Y. This brake is of simple construction, and designed to afford means to exert great pressure on four wheel treads simultaneously by the expenditure of moderate manual force. Transverse bars lapping at their inner ends are pivotally supported to swing horizontally, brake blocks being held on their outer ends and toggle levers pivoted at their inner ends, while links are pivoted to the blocks and the outer ends of the levers, a draught rod being connected to the pivotal support of the levers.

ELECTRIC SIGNAL.—John M. Brasington, Morven, N. C. This invention relates to signals designed to warn an engineer of a break or obstruction in the track in a more effective way than it could be done by lights or signal boards. The invention covers novel features of construction and combinations of parts, whereby a bell is automatically rung by the signal in the cab of the locomotive, the bell continuing to ring until the engineer's attention is attracted. The construction includes a mechanism for setting a signal post on the track by the falling of a bridge or viaduct, and also a portable signal post adapted to be clamped to a rail.

Mechanical Appliances.

SAW FILING MACHINE. — George N. Clemson, Middletown, N. Y. The front edge of one tooth and the back of the adjacent tooth are filed simultaneously by this machine, the stroke of the file feeding the saw one or more teeth as may be required. Combined with the frame carrying the file-reciprocating mechanism is a pivoted guide for receiving and guiding the saw, a reversible file holder, and mechanism for reversing the file to change its angle to adapt it to file the teeth passing in opposite directions through the machine, means being also provided for changing the angle of the file with reference to its longitudinal movement, to cause it to feed the saw at opposite angles during its working movements.

BRICK AND TILE CUTTING MACHINE. —Richard A. Drawdy, Jacksonville, Fla. This invention relates to machines adapted to cut a continuous stream or bar of clay into bricks, tiles, etc., and provides a simple machine by means of which the clay may be rapidly cut, and the bricks and tiles left with well defined edges, means being provided for preventing the clay from sticking to the carrying rollers and for receiving the severed articles from the cutting table proper in such a way that they will not be broken or damaged.

GAUGE.—Sabin F. Brown, Denver, Col. A centrally-pivoted face plate of this gauge is free to vibrate in either direction, and a transverse stop or guide bar behind the face plate serves at its ends to limit the swinging movement of the face plate in either direction. The gauge is of simple and durable construction and designed more especially for use on sheet metal shears and other cutting machines, being arranged to gauge for straight work, such as is done by the ordinary gauge, or for angular cuts, without turning the sheet over for cutting successive sections.

PUMP. — Paden B. Riggins, Sheffield, Iowa. In this pump, the discharge pipe is connected with a lever or other suitable actuating mechanism, and is mounted to slide vertically, being rigidly connected with the piston and forming its piston rod, the lower end of the pipe opening into the hollow piston. A valved suction pipe is held in the lower end of the closed casing in which the cylinder is mounted, a valve in the hollow piston being alternately seated on the apertured top and bottom of the piston.

ELEVATOR FOR MINING CARS. — Thomas Wakefield, Ely, Minn. This cage of this elevator is provided with permanent track rails, and a vertically movable frame hung on the under side of the cage carries movable track rails, means being provided to raise the movable frame and extend the rails thereon between the permanent rails. The construction is simple and durable, and is designed to hold the car or other vehicle in place while the cage is in transit in the the shaft, and securely lock the cage in the uppermost position to prevent accident when loading or unloading.

Musical.

UPRIGHT PIANO. — John U. Fischer, New York City. The case of this piano is completely closed in front by a pivoted key board and adjustable panels, means being also provided for the compact stowage of all parts within a case having no projecting points, to facilitate transportation by reduction of bulk. A lid-vibrating device is also provided designed to enable a skilled performer to produce remarkably fine results in the modulation of sound volume, while the hands are employed in the manipulation of the keys, the escape of the sound volume from the top of the case being controlled by foot pressure.

PIANO SOUNDING BOARD.—The same inventor has obtained a patent for a sounding board designed to be highly resonant, adapted to direct sound toward the top of the instrument, and capable of resisting injury to resonance due to shrinkage of the material. The board is stiffened by vertical ribs on its front face and is plain on its rear face, being held by its edges against the sides and bottom of the case, and supported vertically by a keeper strip at each side edge independently of a back board, from which the sounding board is projected away, forming an intervening unobstructed resonant chamber.

PEG FOR VIOLINS.—George H. Rowe, Belton, Texas. This invention provides a key having a slot or channel extending from a point upon its outer surface diagonally downward in the direction of its center, and thence practically in a horizontal and reverse direction, whereby the string may be expeditiously, conveniently, and securely attached and as readily removed. The angular slot takes the place of the usual string aperture.

Miscellaneous.

OIL PURIFIER.—Rudolph Metz, Philadelphia, Pa. This purifier is adapted to separate and purify oil from waste material, the apparatus being of simple construction and such as may be easily cleaned out while holding the oil so that the purest may be drawn first. It has a main tank with an inlet pipe delivering in jets at the bottom, a strainer over the inlet pipe and an outlet pipe leading from the tank from within the strainer, a hopper in the upper portion of the pipe also having a strainer from which a pipe leads downward into the tank bottom, there being a steam pipe around the hopper pipe, and a number of discharge cocks one above the other in the side of the tank.

SPRING CONVEYER.—Oliver L. Jones, Cold Spring Harbor, N. Y. This is a revoluble screw conveyer adapted to be forced into a bank under constant pressure, so that when kept revolving it will work easily and rapidly, the material being carried by the blade and deposited in the rear of the conveyer, which is adapted for use in either a natural or an artificial bank, as a culm pile. The conveyer, while being forced into the bank by springs, to maintain a constant endwise pressure, is revolved by means of a crank or a pulley to which a belt may be applied.

CASH DISH.—David M. Perine, Baltimore, Md. This is a shallow dish with a thin flexible base, its upper surface covered with a series of rigid nipples, the base being inclined downward toward the center and provided with a drainage perforation, the dish being designed to facilitate the gathering up of small coin returned to a customer as change.

BLANK BOOK. — James W. Burris, Uvalde, Texas. This invention is designed as an improvement upon the Megee-Miller blank book, adapting it for use of typewriters and others requiring a book whose sheets or leaves may be readily detached and again secured together after being written upon. The sheets are detachably connected with a binding strip by means of a cord or cords, the strip being arranged parallel to the folded edge of the sheets and the cord formed into a series of loops which pass through openings in both the sheet and the strip.

WATCH REGULATOR.—Sirus E. Kochendarfer, Hollidaysburg, Pa. This invention provides a device whereby the undue expansion of the hair spring will be opposed and the increased momentum of the balance will be counteracted, in cases of shock or jar, thus permitting of only the normal action of the balance and hair spring and preventing the overheating or breaking of the roller jewel. A lever is pivoted to the regulator arm and furnished at one end with two studs, which embrace the outer coil of the hair spring, and at the opposite end with a single stud, held normally near but not in contact with the outer surface of the outer coil of the hair spring.

GAS STOVE. — Frederick W. Bean, Ogden, Utah Ter. This stove has two closed drums, one within the other, each having inlet and offtake pipes leading to the outer air, there being a burner under the inner drum and a water pipe extending through the two drums. The stove is simple and inexpensive, and is designed to throw out a great deal of heat with the use of a small amount of gas, heating water which may be utilized for a bathroom or otherwise, and affording means for supplying pure air to a room and carrying off all noxious products of combustion.

COOKING UTENSIL. — Patrick Lee, Boise City, Idaho. A multiple cover device for cooking utensils of various kinds is provided by this invention. It consists of a series of parallel apertured plates fitted to slide one upon the other, the lowest plate having an overhanging handle, and a pivot extending through the handle uniting the several plates. It is adapted for use as a close cover when desired for pots, kettles, boilers, and cooking or baking pans, and to fit and receive down within it vessels for cooking generally.

CENTRIFUGAL CREAM SEPARATOR.—Carl A. Hult, Stockholm, Sweden. The casing of this machine is preferably cylindrical, and it is especially adapted as a hand machine, although it has a driving pulley by which the drive shaft may be rotated by power. It is designed to thoroughly separate cream from milk or butter from milk, and the separators have two movements by which centrifugal force is employed in the separation of the fluids, or the solids from the fluids.

BEE ESCAPE FOR HIVES. — Granville H. Ashworth, Sedalia, Mo. When honey is to be removed from the storing chamber, the bees are allowed to escape therefrom into the brood chamber to facilitate the removal of the honey, and to aid in this purpose a board is inserted between the two chambers, centrally in which is a novel passageway forming the subject of this invention. It consists of a rectangular casing with projecting and sloping sides, at one end of which are hung fingers easily raised by a bee to permit of its passage from the storing to the brood chamber, but preventing the backward passage of the bee.

ANIMAL TRAP. — William H. Harden, Quitman, Ga. This trap is intended especially for rats and the like, and the invention provides a simple and novel construction of tripping and self-setting devices, the rat which is caught, in its efforts to escape, resetting the trap for the next rat.

FAUCET. — Samuel I. Merrill, Los Angeles, Cal. This invention relates to lever spout faucets more especially applicable to oil cans, in which the spout when closed shuts up under cover of the can or vessel and when open projects downward and outward. The invention provides for a special construction of such faucet in connection with a recess, cavity or chamber in the can or vessel, where the faucet is securely fastened, and where it will be fully protected and out of the way when the can or vessel is being shipped.

DISPENSING DEVICE.—John Neumann, Brooklyn, N. Y. The cooling and serving of malt liquors at a bar or counter are provided for by this invention by means of a compact, neat, and convenient device, whereby the liquor will be cooled before serving by the glass or measure, and the drainage from the draw cocks will be collected in proper compartments of the device. The apparatus is provided with the necessary pumps and draw cocks, and storage coils located in an ice receptacle, and the dispensing device is portable, to be placed at any desired point within the counter or bar.

SOLE. — Ferdinand Ephraim, San Francisco, Cal. This is an improvement in soles for "ironclad" or hob-nailed boots or shoes, there being attached to the inner sole a wire gauze plate carrying a series of nails clinched to it and having tapering heads adapted to fit in a series of similar tapering apertures in the outer sole or tap, the ends of the nail heads being exposed through the apertures to take the wear. The top lift of the heel may also be similarly protected.

TRACE IRON.—William J. Dankworth, Gatesville, Texas. Two leaves pivotally connected with each other are adapted to fold one on the other, one leaf having a hook passing through an aperture in the other leaf and adapted to engage the trace, and loops being arranged in line with each other on the leaf for the passage of the trace. The iron may be readily connected with the end of the trace without the employment of rivets, and may be easily attached to or detached from the hame.

SASH HOLDER.—Charles Scheibel, San Francisco, Cal. This is a window lock of extremely simple character, capable of application either to an upper or a lower sash. The sash has a recess to which leads a bore in which is a sleeve having a rib, a spindle turning in the sleeve, and an eccentric in the recess of the sash secured to a spindle, to which is attached a handle having a lip adapted for engagement with the rib of the sleeve. The device also acts as an anti-rattler, and serves to prevent the entrance of dust when the sash is locked.

SASH CORD. — Leedham Binns, Philadelphia, Pa. This invention relates to a double loop sash cord or rope composed of a single length doubled over upon itself to form two strands, which are twisted together, thus forming a loop integral with the doubled-over twisted cord at either end of the latter. A link or hook at the upper end of the cord is adapted to pass down through a bore into a pocket in the sash, a locking ring detachably engaging the link or hook within the pocket and preventing withdrawal through the bore.

MEDICINAL FOOD. — Andrew D. McKay, Liverpool, England. The combined constituents of this food are designed to make up a perfect article alike for infants, invalids, and generally for sufferers from indigestion, while the food is palatable and nutritious. The food contains dextrin, egg albumen, pepsin, hypophosphite of iron, hypophosphite of calcium, and other ingredients in prescribed proportions, which are mechanically mixed without the taking place of any chemical change.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE ORGANIC ANALYSIS OF POTABLE WATERS. By J. A. Blair, C.M., D.Sc. 'Edin., L. R. C. P. Lond. Second edition. Philadelphia: P. Blakiston, Son & Co. 1891. Pp. ix, 120. (No index.) Price $1.05.

This little work in very attractive form treats of the albuminoid ammonia and oxygen processes at ordinary temperatures, of the latter process at 100° C., the sulphuric acid process for organic nitrogen, and the sulphuric acid and permanganate process for organic carbon. It will be found a useful *resume* of the well known processes summarized above.

ON THE MODIFICATION OF ORGANISMS. By David Syme. Melbourne: George Robertson & Co. London: Kegan Paul, Trench, Trübner & Co. Pp. vii, 164. No date, no index.

This work is written with the view of showing that the theory of natural selection is not to be absolutely accepted, and that its acceptance is still beset with difficulties of the most serious character. Natural science suffers no greater danger than that from dogmatism and the influence of great names. The theories framed to account for its phenomena and the laws we attempt to draw for it should be open always to criticism. For this reason such books as Mr. Syme's are very welcome and tend to do good.

NOTES AND EXAMPLES IN MECHANICS. By Irving P. Church, C.E. New York: John Wiley & Sons. Price $2.

This is a companion volume to the "Mechanics of Engineering" by the same writer, containing notes and practical examples, algebraic and numerical, to illustrate more fully the application of fundamental principles in mechanics of solids. It has also a few paragraphs relating to the mechanics of materials and an appendix on the "Graphical Statics of Mechanism."

The American Art Printer for April, published by C. E. Bartholomew, New York City, is, as usual, replete with matter of live interest to every *attache* of a printing or publication business who delights in noting the possibilities always afforded by artistic typography and perfect presswork. The gem of the number is a half-tone reproduction direct from a photograph and etched on copper by W. H. Bartholomew, the plate being printed in a regular type form, but presenting a firmness of outline, delicacy of shading, and perfection of detail such as is rarely met with in the finest steel plate work. The numbers of such a magizine should be kept in every office where printing is done or printers being made.

Isaacs' Artificial Perpetual Calendar. We have examined some very ingenious calendars invented by Mr. S. H. Isaacs, of this city, whose functions are denoted by the above name. They consist of stiff pasteboard, to which sliding cards manipulated from the back are adjusted. By properly working the sliding cards all calendar information can be at once procured in a few seconds. Thus, to determine the day of the week corresponding to a given date in the present, in the last or in the next century is an operation requiring but a fraction of a minute for its performance. Two additional tables explain how the tables can be applied to the entire Christain era, and also as far into futurity as may be wished. One of the calendars shows a calendar for a single month, the other one shows a year's calendar. The latter also has a most ingenious arrangement for determining the date of Easter Sunday. In both calendars the leap year is taken full cognizance of, and the data apply for all leap years.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(4274) C. M. P. asks: 1. In using iron rings in the construction of simple motor, 641, would you use the same size as in dynamo, 600? How many would you use? What would be the length of the wood core of armature? A. In the construction of the simple motor you should not depart from the instructions. If you desire to use iron rings in the armature, make them of a suitable width and diameter to form an armature of the size given. 2. Am winding cast iron field magnet with No. 20 single-covered wire, 40 convolutions to layer, 5 layers to coil. Now, how much wire by weight, and what number, must I use on armature? In other words, can I follow the instructions for dynamo 600, only using a less number of iron rings? A. If you intend to use your motor as a shunt machine, wind the armature with No. 18 as directed. It will probably require about half a pound. If you desire to make a drum armature, you can follow the instructions given in SUPPLEMENT, No. 600. 3. Would it be any advantage were I to shellac each layer of field magnet and armature as I wound them? Am I correct in my winding of field magnet as in question 2? A. It would be an advantage to shellac the layers as suggested, but a wrapping of thin paper would answer just as well, and you save the time required for drying.

(4275) W. B. writes: 1. I am making an armature for simple motor in "Experimental Science" and would like to know if an armature made of cast iron and annealed would prove satisfactory? A. Cast iron does not answer well for the core of an armature; better use sheet iron or iron wire. 2. How can I make say 5 gallons of oxygen and 5 gallons of hydrogen on a simple scale? A. You can make oxygen by heating chlorate of potash and black oxide of manganese in a retort, conveying the gas through a wash bottle to the gas bag. In making oxygen, to avoid explosion, you should take care to secure pure materials, and also to guard against the entrance of water from the wash bottle into the retort. You can make hydrogen by placing scraps of sheet zinc in dilute sulphuric acid—acid one part, water ten parts. You can convey the hydrogen from the generator to a bag or pneumatic trough. The hydrogen should be washed in the wash bottle as in the case of the oxygen.

(4276) J. H. R. says: A reservoir to contain thirty cubic feet of air is first filled at atmospheric pressure; could it be compressed to fifty pounds pressure with an ordinary hand force pump in a reasonable time? Also how long would said reservoir run a six horse power engine, the pressure kept uniform throughout? A. You can compress air into the reservoir by hand, but it will take a long time to put 50 pounds pressure upon it by hand. It will run a 6 horse power engine for a few minutes only. You will have to put 15 horse power of work into the compressed air in order to get 6 horse power of work ont of it through an engine.

(4277) W. J. B. says: A cannon is fired perpendicularly from a train moving 60 miles an hour. Where will the ball drop, or will it drop in the place the cannon was at the time of firing? A. The ball has the same forward motion that the cannon has at the instant of firing, and its line fire will travel forward the same as the gun, less the friction of the air, and will return near the gun. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 830, on this subject.

(4278) C. R. Co. asks: 1. I have a 0·75 kilo-watt dynamo of the Edison type which has an E. M.F. of 125 volts. Could storage battery described on the 418th page of "Experimental Science" be charged and then be made to light 40 volt lamps? A. Yes. 2. Would 22 cells of this battery be sufficient? A. Yes. 3. Would the full voltage of the dynamo be too great to charge? A. No. 4. Could you have a box partitioned into about five parts, with mortised joints to make tight, and then lined with asphalt, and use it instead of glass jars? A. Yes, or you can soak the wood in paraffin or beeswax.

(4279) Electric asks: 1. What are the relative advantages in using silk and cotton covered and single and double wound magnet wire? A. Silk is superior to cotton as an insulator. Single covered wire, either cotton or silk, is liable to become bare in spots and thus to become short-circuited or crossed. 2. What are the best kinds of oil for high insulation purposes? Please name some. A. Probably paraffine oil or heavy hydrocarbon oils are the best insulators. 3. What is the chemical composition of vaseline? A. Vaseline is a heavy hydrocarbon.

(4280) K. H. asks how much wire, and what size, is used on the primary and secondary coils of Blake transmitter induction coil? A. Use four layers of No. 24 wire for your primary coil, and 12 or 15 layers of No. 36 silk-covered wire for your secondary. Make the core of a bundle of soft iron wires 2½ inches long and ⅜ of an inch in diameter.

(4281) A. W. T. asks for an explanation of the principle of a simple lightning arrester for a telegraph line. A. A simple lightning arrester for telegraph lines consists of a pair of serrated plates, one being connected with the line, the other with the ground, the teeth of the plates being placed very near each other but not in contact.

(4282) Subscriber asks: 1 Please state what solution is put in cup of a Leclanche battery. A. A nearly saturated solution of sal ammoniac in water. 2. Will one large cell of said battery operate one bell? A. Yes.

(4283) H. W. P. asks: 1. What does phosphorus contain to make it visible in darkness? A. Slow combustion is the cause; the phosphorus combines with the oxygen of the air. 2. Can you give a menstruum that will corrode iron very fast? A. There is none better than acids, such as hydrochloric. 3. Would the solvent have any effect on rubber? If so, how to prevent it? A. None. 4. How long would it take to go through six inches of iron or steel? A. With constant renewal it would take many hours. 5. Place a dime on your tongue, and a piece of zinc between your lips and teeth, leave space between your teeth for the two to connect. What do you experience? A. The slight electric current may decompose the fluids of the saliva. Ordinarily it is attributed to the current, and this may have a part in it. The zinc is attacked, and may contribute to the taste.

(4284) A. S. T. asks (1) for dimensions for a spark coil used in electric gas lighting. A. Use a core consisting of a ¾ inch bundle of soft iron wires 18 inches long. Upon this wind 12 to 18 layers of No. 18 magnet wire. 2. Amount and size of wire for the electromagnets (about the usual size) for a bell to be rung over a line of 1,000 to 1,200 feet of galvanized iron wire by five cells of Leclanche battery. A. For a bell to be operated over the line described use about 300 feet No. 24 wire on the bell magnet.

(4285) G. W. W. writes: I want to make an illustration by having some perfectly clear liquid to begin with, then add something that will make it dark or muddy, then again add another liquid which will make it perfectly clear again in a few seconds. What chemicals and how much of each will be required? A. Use very dilute solution of copper sulphate or iron chloride. Add dilute solution of caustic soda. This gives a precipitate. Add hydrochloric acid, and the mixture clears.

(4286) E. C. S. asks (1) of what silicate of soda is composed and how it is made. A. Of silicic acid and sodium oxide. It is made by dissolving silica in caustic soda solution. 2. How long has it been in use? A. For many years. 3. What chemical will change its appearance without destroying its adhesive qualities? A. None, except as regards coloring it. Aniline dyes and cochineal will do this.

(4287) R. H. of Japan asks: 1. What would be the best means to prevent the steel rails used in the copper wire from corroding in the water saturated with the copper salts? A. You cannot prevent it, except by excluding the water. 2. To what distance will the voice tube be effective? A. About 500 feet. 3. Or what would be the cheap method of sending message to a distance within a mile? A. Bell or acoustic telephone.

(4288) E. W. asks: Have hydrogen, air, oxygen, etc., the same mechanical and expansive properties as steam, when compressed? A. The properties are the same, but differ in degree. Gases all vary more or less, especially when near their liquefying points.

(4289) C. H. S. asks: 1. Is the calcium light for magic lanterns, in which ether is used instead of hydrogen, a success? Is ether as good as coal gas? A. Ether answers very well for the purpose, but we think gasoline is preferable. Neither of them answers as well as coal gas. 2. Please describe how to make an ether saturator for this purpose. A. The gasoline or other fluid is placed in a double-necked bottle containing pieces of sponge or shreds of cloth, or any porous material that will absorb the liquid. The air to be charged is contained in a bag, which is weighted and connected with one of the necks of the double-necked bottle, the other neck being connected with the burner. An annular burner is preferable for this arrangement. 3. What kind of colors are used in coloring lantern slides, and how applied? I would be obliged for references to any books or articles in the volumes of the SCIENTIFIC AMERICAN on the principles and management of the magic lantern and the making and coloring of slides. A. Transparent oil colors, such as are used by artists, are commonly employed for painting lantern slides. Only transparent colors can be used for this purpose. They are mixed with varnish and applied quickly to the slide, so as to allow the colors to flow and become smooth. We recommend the following books on the lantern: Wright's "Projection," price $3; Howorth's "Book of the Lantern," price $2; and "Experimental Science," price $4.

(4290) H. W. writes: 1. I have an induction coil which gives ½ inch spark with 1 large cell, Grenet; how many cells will it take to make a spark ⅛ and ¼ inch, and will it charge a Leyden jar? A. If the capacity of your induction coil is a one-eighth inch spark, you cannot increase it much by the addition of more battery cells. The coil will charge a small Leyden jar. To do this, connect one terminal of the secondary wire with the inside coating of the jar and the other with the outside, placing the jar on an insulating support. 2. Will you give me a prescription of a paint to put inside of boxes and use them instead of battery jars? A. Saturate the boxes with paraffine to render them acid proof. 3. If I make a dynamo as large again as the original, using double the amount of the same size wire as is on the machine, will it have 8 times the capacity and light 8 times the number of lamps? A. You should increase the diameter of the wire in the same ratio in the rest of the machine. By so doing, the machine will have eight times the capacity. 4. Will you please tell me how to make a magneto, or is there a SUPPLEMENT in which one is described? A. You will find one form of magneto described in SUPPLEMENT, No. 162, under the head of telephone calls. 5. How can I tell platinum from silver, German silver, etc.? A. Test it with nitric acid or by heat; platinum is not affected by nitric acid. Silver and German silver will melt in an ordinary flame, while platinum will not. 6. How many amperes does a cell of Grenet give, the carbons (2) being 9 inches by 2 inches by ¼ inch, and 1 zinc, 2¼ inches by 4 inches by ⅜ inch? A. The E.M.F. of the battery is practically 2 volts per cell. By dividing this by the resistance of the battery and circuit you will have the current in amperes. For instance, if you have two cells connected in series you will have an E.M. F. of 4 volts. Now, if the resistance of your battery and circuit is 1 ohm, you will have 4 amperes of current; if it is 2 ohms, you will have 2 amperes; if it is 4 ohms, you will have 1 ampere, and so on.

(4291) H. L. M. asks: 1. What other acid, except sulphuric acid, could be used in constructing a voltaic cell? A. Nitric acid is used in the Grove cell, and chromic acid in the Bunsen cell. 2. What kind of battery should be used for a small electric bell? A. For an open circuit, the Leclanche battery in some of its modifications, or the Fuller battery. 3. What ought to be the price of a battery to be used for the same bell? A. The price of batteries for bells ranges from 75 cents upward. 4. Which is the most precious metal? A. It is difficult to say which is the most precious metal, owing to the variability of prices. Vanadium is $22 per gramme, lithium $15 per gramme, thorium $29 per gramme, rubidium $20 per gramme.

(4292) J. K. asks how lantern slides, which have the subject produced on them by means of photography, may be colored, and what are the best colors to be used? A. There are several different methods of coloring lantern slides. Probably the most satisfactory for the amateur is to use transparent oil colors for the broad surfaces, applying them to the glass side of the slide, afterward varnishing the slide to give the colors greater transparency. Another method is to use the liquid colors commonly employed in coloring photographs. These may be applied to the film side of the slide. Where very broad surfaces are to be covered with bright colors, colored lacquers applied to the glass side of the slide answer very well.

(4293) T. S. S. writes: I have about ¾ pound of No. 32 (B. & S.) cotton-covered copper wire which I would like to use in making an induction coil. I have also a Crowfoot gravity battery of 4 cells (line size 5 inches by 8 inches) which I wish to use for the primary current. To get the best results with the above, will you please let me know what size wire to use for the primary, how many layers to wind, how long and of what diameter the core should be? A. Make the core of your coil of a bundle of soft iron wires ⅝ of an inch in diameter and 6 inches long; insert this in a thin spool, and on the spool wind two layers of No. 18 wire for the primary, and on the primary place three or four layers of strong paper, which should be coated with shellac varnish. Upon the paper wind your No. 32 wire; there should be at least 10 or 12 layers of this wire. For particulars as to condensers and other accessories consult SUPPLEMENT, No. 160.

(4294) B. S. E. L. Co. writes: Please explain the three-wire system of incandescent lighting. A. In the three-wire system the two dynamos are connected in series and the neutral wire is attached to the connection between the dynamos. In the normal working of the apparatus the lamps are arranged practically in series of two, and the current, flowing from the positive of one dynamo to the negative of the other, passes through a number of these series arranged in parallel, so that while the voltage is double that of the two-wire system, each lamp has practically the same current as in the two-wire system. So long as the lamps on opposite sides of the neutral wire are in balance, the neutral wire conveys no current whatever, but when the balance is disturbed on either side of the neutral wire, it returns the surplus of current.

(4295) J. B. B. writes: Parker's philosophy, 1858, page 302, says magnetic and electric power is confined wholly to the surface of bodies, and is independent of its mass. If that is a fact, would not hollow wire be a better conductor for electricity, diameter being equal, than a solid wire, and a tube make a stronger magnet than a solid bar, on account of the greater surface? I never saw tubes recommended for those purposes. A. In the case of frictional electricity and high tension alternating currents, the outer surfaces of bodies seem to convey the greater portion of the current, but in all other cases it is found that the conductivity of a body is in proportion to its sectional area. Tubes have been used for conductors, but there is no particular advantage in their use.

(4296) L. E. J. asks: 1. If a wheel of a given diameter made of copper or any other metal capable of withstanding the strain be revolved at the highest possible speed, would a dry atmosphere surrounding such a wheel become heated or would the velocity of the wheel cause a cooling of the same? Is there any limit to the number of revolutions that can be produced in a solid wheel or shaft? A. Air by excessive friction as you describe is supposed to increase in temperature. We have no data at hand on this subject. The speed of revolving wheels is only limited by mechanical possibilities; 50,000 revolutions per minute has been claimed for small wheels; 20,000 revolutions is claimed for the driving wheel of the new momentum torpedo.

(4297) S. O. S. writes: I am making the simple motor described in "Experimental Science," and would like to know if the shaft can run on oiled wood, and can I make the armature ring out of iron? A. You can use wood for your journal boxes if you prefer to do so. Use the end of the grain for bearing purposes and have it thoroughly saturated with oil. The motor will operate with a ring of solid iron, but it will not be nearly as efficient as it would be if laminated or made of iron wire.

(4298) C. W. Y. asks how to connect the terminals of the winding on a three armed motor armature. A. You can connect each pair of adjacent terminals with a commutator bar, the commutator having three bars. Connected in this manner, the current will flow as in a Gramme ring, or you can connect one set of terminals together at one end of the armature and connect the other set with a commutator having three bars.

(4299) G. P. K. wants a toning solution and the amount necessary for 2½ by 4 prints (silver paper). A.

Water	3 oz.
Bicarbonate of soda	1 gr.
Common salt	2 "
Chloride of gold	1 "

(4300) W. P. D. writes: 1. I have an air pump, the receiver of which is stuck to the brass plate. When last used some four or five years ago, the edge of the glass was smeared with oil to insure contact. Do not know what kind of oil. Ether or benzine will not start it. How can I get it off? A. We think kerosene oil applied to a joint will soften the hard oil, if allowed to stand two or three days. If you do not succeed with the kerosene, you might try a solution of caustic potash or soda in water. If this fails, possibly you may be able to accomplish the desired result by heating the plate slowly and carefully until the oil is softened. 2. Repairing a battery in which the carbon plates are held in position by soldering to metal plates. How can I tin or plate with metal the carbons to hold the solder? A. You should paraffine the ends of the carbon plates to which you desire to apply the connections, by heating the ends and rubbing on paraffine, allowing it to soak in. Care should be taken to not allow the paraffine to extend to the part which is to be immersed in the battery solution. The paraffined ends you can electroplate with copper, and to the copper plate you can solder your connections, or if you desire a simpler method you can cast lead upon the paraffined ends. In this case care should be taken to pour the lead as cool as possible.

(4301) J. H. J. C. writes: How to ascertain if water that flows and stands in galvanized iron pipes contains a solution of zinc. A. Concentrate by evaporation, add a slight excess sodium hydrate, filter if necessary, and pass sulphureted hydrogen through it. A white precipitate indicates the presence of zinc.

(4302) N. L. asks: The way in which to put a canvas razor strop in the best condition? A. Oxide of tin or the putty powder of the shops mixed with sweet oil to a thick paste and spread thinly on the strop makes an excellent dressing.

(4303) C. C. L. says: Will you inform me through Notes and Queries as to what is the cause of the popping of corn? A. The popping of corn is supposed to be caused by the generation of steam from the water combined with the starch and gluten, which by its pressure ruptures the cells.

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(4304) F. K. asks what arsenic is used for in the manufacture of wall paper? What grades of paper is it mostly used in? A. It is used in green and other colors; sometimes in those where it would be least suspected. It is also claimed that it finds its way in with the glue sizing, having been used as a preservative of hides and stock from which the glue was made. No grade of paper can be specified in which it is specially to be apprehended.

(4305) J. W. asks for a method of cleaning papered walls. A. If not very dirty, the paper of any room will be much improved by brushing it over in straight lines with a soft broom, covered with a clean, soft cloth; if, however, the paper be much soiled, very stale bread is the best thing to clean it with. Cut a very stale loaf into slices, and in the lightest manner wipe the paper with it in a downward direction. Clean about a yard at a time, all one way.

(4306) J. B. asks: 1. Can "carbon copies" from typewriter be fixed so as not to rub off? If so, how? A. Prepare water starch, in the manner of the laundress, of such a strength as to form a jelly when cold, and then apply with a broad camel hair brush, as in varnishing. The same may be done with thin cold isinglass water or size or rice water. In lieu of this treatment you may use the fixative commonly employed for fixing drawings. This is applied with a spray tube or automizer. 2. What is the difference in the winding of a direct current dynamo and an alternate current dynamo? A. In a direct current dynamo all of the coils are commonly wound in the same direction. If wound alternately in opposite directions, the current is made to pass in one direction, over the circuit by means of a commutator. In alternating current machines, the coils of the armature are wound alternately in opposite directions and the curreut is not corrected.

(4307) J. T. asks for the best and safest method to generate chlorine gas in small quantities. A. Simply expose bleaching powder to the air, and chlorine will be evolved. Addition of an acid, such as hydrochloric, will accelerate the operation. By acting on manganese binoxide with hydrochloric acid, especially if warmed, chlorine can be evolved in large quantities.

(4308) C. T. B. asks where "sodium ethylate" (mentioned in SCIENTIFIC AMERICAN, No. 24, December, 1889), for the removal of hairy moles, can be procured or how it can be made? A. Address a wholesale dealer in chemicals. It is made by dissolving metallic sodium in alcohol. The latter should be anhydrous or absolute.

(4309) J. W. T. asks: 1. How many cells of storage battery and approximateweight of same would be required to run one-half horse power motor for at least ten hours without recharging? A. It requires eight cells of storage battery for a horse power. For running your one-half horse power motor for ten hours you would require eight cells. 2. In an alternating current transformer, what would be the effect on the primary circuit of a short circuit in the secondary with no fuses in circuit? A. The primary and the secondary wires would both become hot.

(4310) E. S. A. asks: What size wire to use for connecting field magnet terminals with brushes and binding posts of the eight light dynamo, described in SUPPLEMENT, No. 600, also what size conductors to use in distributing lamps through a room? A. For connecting the field magnet terminals use No. 12 or No. 14 wire. For conductors for conveying away the current you can begin with No. 16, which you can use throughout unless you desire to reduce the size, in which case use No. 18 for the branch wires, and No. 20 for the conductors leading to the lamps.

(4311) W. B. R. says: I have two pounds No. 30 double cotton-wound copper magnet wire with which I wish to construct an induction coil. What number and how many layers of wire should I use for the primary? What size core of soft iron wires should I use? How long should the coil be? Could I run the above coil with a magneto-electric machine with alternating current, or would I get better results from the coil to use batteries and a circuit breaker? A. No. 30 wire is rather large for a small spark coil; however, you will be able to make a coil which will yield a heavy but short spark. You will find the instructions you require in SUPPLEMENT, No. 160. A magneto of suitable size, with a winding adapted to the primary coil, would be preferable to batteries.

(4312) F. P. writes: 1. I have made the small dynamo described in SUPPLEMENT, No. 161, as per instructions. I have tried to run a 12 candle power 20 volt Edison incandescent lamp, without any success. What is the trouble? Is it too low voltage of the machine? If so, can I increase it enough by magnetizing the fields with a battery, and how many cells would it take? A. The dynamo referred to has an E. M.F. of about 12 volts, which is obviously insufficient for running a 20 volt lamp. You can run two or three five or six candle power low voltage lamps with the machine, but you cannot increase the voltage to 20. 2. Which dynamo do you think would give the better results, in the way of running incandescent lamps—the one described in SUPPLEMENT, No. 600, or the one in No. 844? A. The Edison dynamo described in SUPPLEMENT, No. 844, is undoubtedly more efficient than the dynamo described in SUPPLEMENT, No. 600. 3. Have you any book that would be advisable to study in connection with making a dynamo, in order to learn the fundamental principles? A. "Experimental Science" will probably meet your wants. Price by mail $4.

(4313) C. W. N. says: If you will tell G. E. T. (No. 4223, issue April 16) to leave off or quit his coffee, there is no doubt but that he will have no nervous irritability to complain of. Many will exclaim nonsense to this advice, but it costs only a bit of self-restraint to try the remedy a couple of months, and that can do one no great amount of harm.

(4314) M. D. asks: 1. What is meant by shunt-wound dynamos and alternating current dynamos? A. A shunt-wound dynamo is one in which the current divides at the brushes, part of it going from one brush through the field magnet back to the other brush, the other part going from the same brush to the external circuit and back to the opposite brush. An alternating current dynamo is one which generates a current formed of equal and opposite pulsations. The alternations occur with very great frequency. 2. Can the motor described in SCIENTIFIC AMERICAN SUPPLEMENT No. 641 be used on an incandescent lamp circuit of about 110 volts? A. Its resistance is too low for use on a 110 volt circuit. 3. How many feet of Nos. 20, 30, and 36 copper wire is required for a resistance of 20 ohms? A. 1924·2 189·32 and 47 feet respectively. 4. What is the object in low-speed dynamos? A. They are designed to avoid belting by the connection of the armature directly with the engine shaft. 5. What is a rheostat, ammeter, and galvanometer? A. A rheostat is any variable resistance which may be thrown into a circuit. It generally consists of a series of coils of different resistances, with switches for throwing the coils in and out of the circuit. An ammeter is an instrument for measuring amperes. It is a form of galvanometer having a coil without appreciable resistance. A galvanometer is an instrument consisting of a magnetic needle suspended within or above a coil and designed for indicating the direction of the current, and for use in connection with a rheostat for measuring currents. 6. How is soldering fluid made? A. By dissolving zinc in muriatic acid until it will dissolve no more, then diluting the solution with an equal bulk of water. 7. Could I use No. 16 paraffined office wire to wind cast iron field magnets of motor 641? Or would it be best to remove first layer of insulation? A. The insulation of office wire is too thick for use on electro magnets. Better purchase magnet wire. 8. Will ten coils do for armature as well as twelve? If not, why? A. By multiplying the number of coils the tendency to sparking and burning out the armature is diminished. 9. What changes would be necessary to use this motor as a dynamo? A. Use a cast iron field magnet and wind the armature and magnet with No. 20 wire.

(4315) J. F. C. says: Within a space of four years two barns have been struck by lightning and burned on the same spot of earth—no rock, no gravel. Does this indicate iron or other metals? There are three stones in an ancient temple in Syria, or near foot of Mount Lebanon, 71 feet by 14 feet by 13 feet and one the same size on pillars at quarry one mile away. Could our engineers move this one to the temple. Could they handle the stone forming the overhead ceiling to room in the great pyramid or the largest stone in the old wall at Jerusalem? Has any analysis of Egyptian mummies determined whether anything more than common salt was used in mummifying process? If so, what? A. We can only add that it is an old saw that lightning never strikes twice in the same place, yet in this case it does not indicate mineral attraction. The great stones weigh about 1,000 tons. Captain Eads' ship railway was to carry several times this weight across the isthmus. The Great Eastern was the greatest block that modern engineers ever stumbled on, beside which the stone blocks are pygmies. There were probably other preservatives than salt used on the mummies. The dry air of Egypt was the principal preservative.

(4316) J. W. K. asks: I would like to know if a telegraph sounder can be so injured by long use of an excessive amount of battery as to afterward render it unfit for use with a normal amount of current, say from one cell gravity battery. I have one that has been in use for about a year with three cells gravity battery, and upon trying to use it with only one, it fails to work in a satisfactory manner. If it can be and is so injured can you suggest a remedy? A. The resistance of the winding of the sounder magnet may have been very slightly increased by the use of an excessive current, but we do not think it would be appreciable in the ordinary working of the instrument. If you examine the sounder and the connections of the wire carefully, you will probably find a poor electrical connection at some point, or possibly the trunnions of the sounder lever work with too great friction. If you have used a current which has burned out the insulation, of course the only remedy is rewinding the magnet.

(4317) J. S. S. asks: 1. What is the cause of the bursting of an emery wheel when running at a high speed? A. It is generally due to lack of cohesion among the particles of the wheel, the wheel having insufficient strength to withstand centrifugal force. The remedy is obviously stronger wheels or less speed. 2. What effect would the opening of a window have upon a vulcanizer, with the pressure above the limit of safety, the cool air blowing through the window on the vulcanizer? A. The tendency will be to cool the vulcanizer and reduce the liability to explosion. 3. How is the specific gravity of a body obtained? A. Specific gravity is obtained by weighing the body in air, then weighing in water and dividing the weight in air by the loss of weight in water.

(4318) C. B. asks how to purify rancid butter. A. This can be done by melting in twice its weight of boiling water and shaking well. Pour the melted butter into ice water, allow it to regain its consistence. Another plan is to beat up ¼ pound good fresh lime in a pail of water. Allow it to stand for an hour until the impurities have settled. Then pour off the clear portion, and wash the butter in that. Butter so treated is never as good as fresh butter.

(4319) W. J. N. asks: Is it correct to put a globe or any valve in a steam pipe with the pressure on top of disk? There is a gentleman who claims to be quite a mechanic, says the pressure should be at top of disk. I say it should be on the bottom of disk. A. You are right. All valves should shut against the source of steam supply. This enables the packing of the stuffing boxes with steam on the boiler.

(4320) L. W. A. asks why an injector works. The best informed machinists I have met cannot tell. Others say there is more pressure on top than on bottom of boiler. I thought I had discovered the reason why it works, but was told that the feed pipe is sometimes larger than steam pipe. At any rate, if you close one cock more than the other on a glass gauge you can fill it with water or, by reversing, blow it all out. A. The theory in regard to the mechanical action of the injector is based upon the transfer of the momentum of steam at a high velocity to the surrounding annulus of water at the point of contact and the instantaneous condensation of the steam into water. The water of condensation by its impact at the high velocity of the steam gives momentum to the surrounding water equal to overcoming nearly double the boiler pressure, or, in other words, it is the impact of the condensing steam at a high velocity that carries the feed water through the nozzle with sufficient force to overcome the resistance from the boiler pressure.

(4321) E. D. W. says: A fence is to be built over a half circle hill. Another over a straight line being the exact diameter of the above half circle. The specification calls for posts placed 2 feet apart. Which job will require the greatest number of pickets? A. If the pickets are placed vertically, it will require the same number of pickets for both jobs. Not so with the rails, as is self-evident.

(4322) H. A. U. asks whether he is right in his belief that phrenological examinations, executed in the hands of a competent person, indicate true results or not, and whether phrenology is an established science or not. A. Phrenology is not considered an exact science, but there is enough in it to make it very useful as a system by which character and propensities can be known and recorded by persons proficient in the manipulation of the outward signs.

(4323) A. E. L. writes: I have two pieces of gas pipe, one telescoping the other. The large piece I wrap with a piece of flannel, the smaller one I heat over a lamp and insert in the larger one; the flannel then becomes moist. How can I heat the flannel without the presence of moisture? A. We suggest the use of an unglazed porcelain tube for the outer tube.

(4324) J. F. asks: 1. Will not a soft iron plate answer for an insulator of magnetism for a magnetic motor or a perpetual motion machine? A. A soft iron plate will cut off the magnetism, but it requires power to remove it from the magnetic field. 2. What size wire is used on the field magnet of the simple electric motor described in SUPPLEMENT, No. 641. A. No. 18.

TO INVENTORS.

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AND EACH BEARING THAT DATE.

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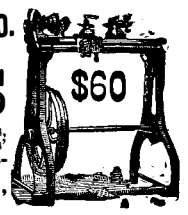

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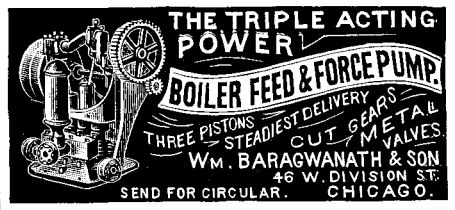
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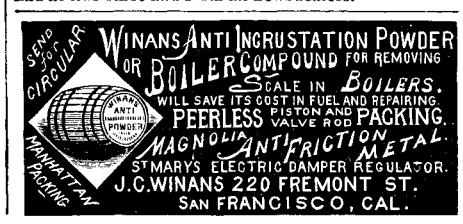
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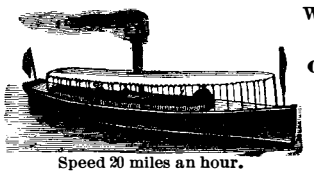
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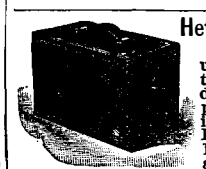
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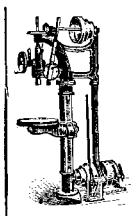
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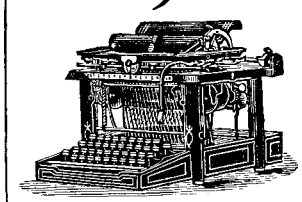
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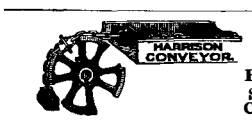

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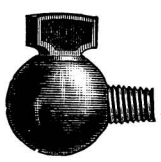

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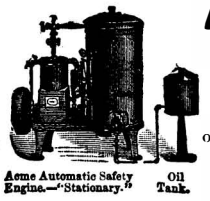

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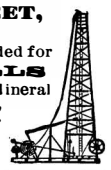

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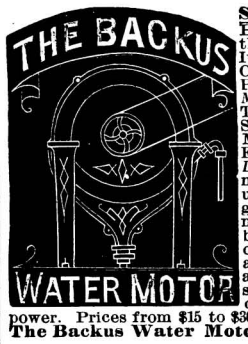

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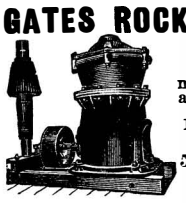

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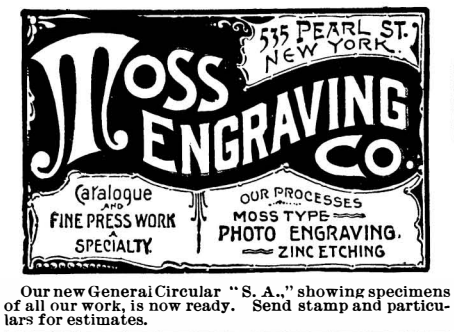
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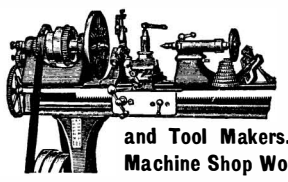

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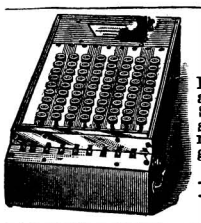

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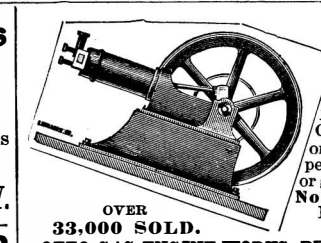

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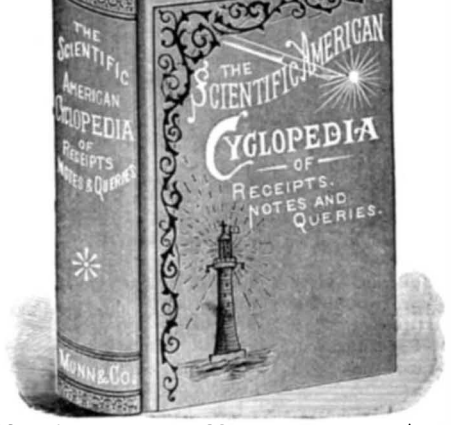

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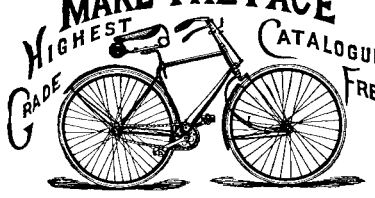

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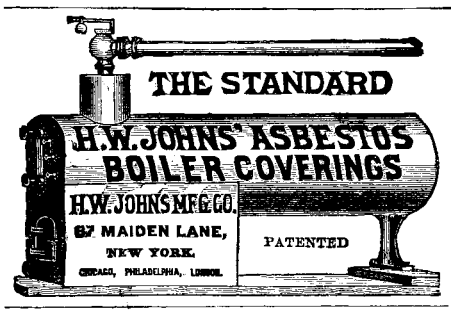

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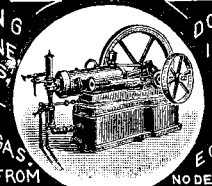

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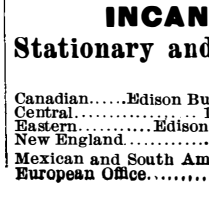

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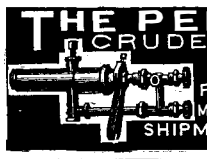

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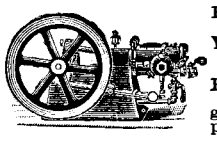

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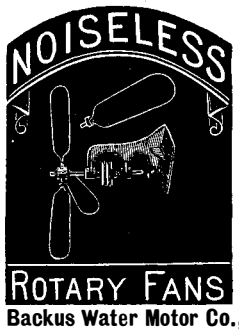

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